AUTOMATED MENU PLANNING

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INTRODUCTION

The food service industry in the United States of America is a rapidly expanding multi-billion dollar industry. Projections for estimated value of food consumed in away-from-home eating situations are $26 billion for 1965, and over $34 billion by 1980 (Broten, 1965). Acute problems confront this industry, chief among them being reconciliation of ever-rising costs of production with maintainance of quality output and adequate profit margin. Development of the food service industry not only has been slower than that of other major enterprises, but has been hampered by lack of fundamental information providing the basis for efficient control.

Until recently identified mainly with hospitals, dietitians are now an integral part of the food service industry at large. Emphasis in academic preparation has been on scientific principles of nutrition and traditional methods of food production management. Too often dietitians have become involved in routine clerical tasks and have given little or no attention to managerial aspects of the work. Repeated criticism of their performance arises from apparent failure to apply concepts of industrial efficiency and economy to the administration of food services.

Automated techniques in manufacturing and application of electronic data processing in business, marketing, and science have resulted in profound changes in traditional

methods of management. Evident in many fields, the computer has presented management with a tool that when properly programmed, is reliable, quick, and has the added advantage of a colossal memory. Further, it is flexible, requires no training, and is neither temperamental nor prone to absenteeism. Continued shortages of adequately prepared administrators plus various pressures resulting in the need for quick decision-making and problem-solving efforts have focused attention upon the use of computers and automatic data processing as a managerial tool in food service systems. Increasing numbers of applications have been noted in such areas as inventory control, fiscal control, dietary calculations, cafeteria line simulation, and some limited menu planning with emphasis on nutritional content and cost.

A vital factor in any food service is the menu. It is the hub of all food service operations and largely influences financial stability. A time-consuming duty when properly done, menu-planning requires consideration and interrelation of many factors such as: (1) age, sex, and occupation of group to be served; (2) climate and season; (3) flavor and appearance of food; (4) variety; (5) type of food service; (6) number to be served; (7) food budget; (8) equipment available; (9) number and experience of employees; (10) availability and seasonability of foods; (11) cooked foods on hand; and (12) recipes to be used (Fowler et al., 1961). Successful integration of all these

factors is essential for efficient food service. Objective evaluation is difficult.

Emphasising nutritional and cost factors and certain acceptability factors, several computer programs for planning menus have been formulated. However, proper nutrition is attained not only through a nutritionally adequate diet but also consumption of the food. Therefore nutritious food must be as attractive and appetizing as possible. The computer program should include acceptability, palatability, and management factors in food production and service.

The aim of this study was to develop a computer program to plan a non-selective menu with emphasis on color, shape, texture, and flavor suitable for service in university residence halls.

REVIEW OF LITERATURE

Menu Planning

Goals. Three distinct goals of menu planning for food services, according to Smith (1963) are: (1) fulfillment of nutritional needs; (2) consideration of cost factors; and (3) palatability of the food. The United States National Research Council (1964) has defined quantities and classes of foods necessary for optimum nutrition with regard to age, occupation, activity, and habits of the people. Smith (1963) said that economy should be achieved in the utilization of labor, equipment facilities, and time available for

preparation and service of food. Factors of contrast and balance in the aesthetic quality of food are important in determination of eventual nutritional value of that food, as only food that is eaten has actual nutritional value to an individual. Color contrasts, flavor, texture balance, variety in shape and size of food, as well as in different preparation methods help make wholesome food more attractive, and thus more likely to be eaten. General well-being, noted Dylla (1962), resulting from nutritional adequacy could be related to performance in classrooms. One commercial food service used popular menus to attain nutritional standards for high school students.

Qualifications of Menu Planners. Frahm (1965) stated that planning menus challenged intelligence, imagination, and skills of the menu planner. Many authors commented that menu planners need scientific knowledge of principles of good nutrition, creative ability, and imagination to present interesting and attractive combinations of food. Kinder (1963) explained that part of a "satisfying dining experience" was achieved by providing pleasing relationships of texture, flavor, and color in foods accompanying the main dish selection.

Menu Planning Factors. Food had a psychological aspect, stated Frahm (1965), and satisfaction of psychological and aesthetic factors needed careful consideration. Sight of food, its color, shape, size, and surface should tempt

people to eat, declared McLean (1959). Many things influence the planning of menus such as texture, flavor, color, shape, variety in preparation methods, variety in foods, and other factors.

Texture. Results obtained in a word association test used to determine consumer awareness of food attributes, according to Szczesniak and Kleyn (1963), indicated that texture was a discernible characteristic of food, and was more evident in some foods than in others. Highest numbers of texture responses were given either for bland-flavored foods or for foods with characteristics of crispness or crunchiness. Texture was the most-mentioned response, followed by flavor, then color.

Variations in texture and temperature of foods in a meal, pointed out McLean (1959), add to the attractiveness of a meal. Although a meal of soft foods was disagreeable to some age groups, a meal of coarse and scratchy foods was also unpleasant to eat. However, much satisfaction may be derived from contrast and variation in texture (McLean, 1959). Degree of cooking, noted Hughes (1962), greatly influences texture.

Flavor. McLean (1959) observed that the sensation of flavor was interrelated with odor, taste, feel, and texture. Taste referred to tongue taste, but in popular use was synonomous with flavor. Four basic tastes are sweet, sour, salt, and bitter; however, most foods are blends of two or more flavors. Combination and contrast of tastes in recipes

and menus resulted in more eating pleasure. Many variables occurred in human taste. Research showed: (1) people were able to taste over half a million flavors; (2) taste sensation and sense of smell were interrelated closely; (3) taste buds detected only degrees of salt, sweet, sour, and bitter flavors; and (4) taste was affected considerably by appearance (Anon., 1964).

In a report of a study of psychological expectations of perceptions and preference for different taste mixtures, Gregson (1963) concluded that subjects demonstrated a high degree of error in perception of mixtures preferred. Degree of real insight varied considerably between individuals. Based on these results, existence of interrelationship between taste, vision, and other senses was suggested.

A balance between taste and flavor should be achieved, observed McLean (1959), so that excessive use of intense flavors within one meal does not dominate more delicate flavors. The recommendation that not more than one strong-tasting food should be present in one meal was repeated throughout the literature.

Color. Color is the only aesthetic factor of food that can be evaluated by objective measurement. Color of food could determine its acceptability (Anon., 1965). Colors naturally associated with foods were more appealing than unfamiliar colors, and clashing colors were unpleasant (McLean, 1959). Birren (1963, p. 553) stated that "color is forever a part of food, a visual element to which human

eyes, minds, emotions, and palates are very sensitive." Hues in the red-orange range of the color spectrum seemed to arouse agreeable sensations, whereas the color with lowest appetite appeal was in the yellow-green range.

Shape. No scientific studies of form of food related to its acceptability could be found. However, many authors recommended careful attention to form of foods in a meal and variety in shape as aids in overcoming monotony and adding interest (Fowler et al., 1961, p. 334). Irregular shapes, commented McLean (1959), or natural shape of foods are often more attractive than smooth or definite shapes.

Variety in preparation methods. According to McLean (1959), variety in presentation of food is the criterion of good menu planning. Provision of variation in preparation and cooking of food from meal to meal requires imagination and adds to the enjoyment of food. If preparation and cooking of food differs greatly from traditional methods, food may often be rejected (Hughes, 1962).

Variety in Food. Reactions of volunteers to monotony in food over a period of 24 days were reported by Kamen and Peryam (1961, p. 173), who stated that "proneness to monotony is a dimension along which foods may be evaluated," and that individual points of reaction were highly subjective. In trials, 2 diets were preplanned and 1 was self-planned. With restricted food items available, self-planned diets were preferred, and morale was higher in that group.

Repetition, concluded Schutz and Pilgrim (1958), resulted in reactions to monotony of lowered consumption and preference ratings. Monotony might be related to initial preference and palatability of food. Fruits, desserts, and staples did not significantly change in preference rating. Cereals were rated higher, whereas meat and vegetables decreased in rating as testing progressed.

Other Factors. Fowler et al. (1961) considered factors affecting menu planning in 2 categories; those directly affected by clients or guests, and those related to management. Factors to be considered in relation to the group being fed were age, sex, and occupation of its members, as determinants for nutritional requirements; suitability of foods for the group; consideration of economic levels, ethnic, cultural and religious influences; food preferences; and tradition.

Management factors of menu planning were type of food service, number served, and time lapse between preparation and service; budget allowances and balance between high- and low-cost menus; purchasing procedures, season, and storage facilities; available equipment and work space that might limit use of some types or combinations of foods in meals; number, experience, skill, and responsibility of personnel; organization and distribution of work, time management, and time available for preparation; and standardization of recipes and procedures. Finally, overall

policies of an institution would have direct bearing on selection of foods in each institution (Fowler et al., 1961).

Application of Computers to Decision-Making

Application of electronic data processing in business and industry, observed Salveson (1963), has been one of the most profitable innovations of this century. Reduction in labor costs; increased total output; improved quality of production; better working conditions because of improved utilization of time, personnel, and physical plant; and survival in a competitive world were given as valid reasons for automation by Kruger (1963). Computers have had a profound effect on management processes, and their application to decision-making has resulted in a new "information technology." Salveson (1963) hypothesized that computers have extended the ability and scope of human minds to think, manipulate information, and make decisions. Traditional methods of decision-making have undergone re-evaluation and re-specification (Whisler and Shultz, 1962).

Computers are able to examine and evaluate many possible solutions within a short period of time. Before submitting data to computer processing, an operation must be studied in depth and detail, and all aspects of the problem and methods of solution precisely defined, pointed out Salveson (1963). Quality and value of computer decisions will depend directly on reliability of data and analysis presented as input.

Improvement in operation and profitability occurred in 3 ways, according to Salveson (1963), after introduction of computers for managerial decision-making. Computerized management demanded and provided greater understanding of an entire operation. Better analysis and information was permitted at all stages of planning, decision, and control. Generally, cost reduction was realized as well as increased quality of "information processing" in operations which were automated.

Menu Planning by Computer

Minimum Cost Subsistence Diets. A mathematical model of a diet emphasizing minimum cost of physiological subsistence was first solved by Stigler in 1943 (Smith, 1963). The diet was planned for a 70 Kg male city-dweller. Nutritional standards were based on recommended dietary allowances of 1943, and retail prices on reports of Bureau of Labor Statistics. Allowance was not made for variety, palatability, or cultural considerations. Foods used were enriched wheat flour, corn meal, evaporated milk, peanut butter, lard, cabbage, potatoes, spinach, dried navy beans and beef liver.

Toussaint (1959) reviewed a study by Francovic et al., in which linear programming techniques were utilized to check Yugoslav family food expenditures against physiological dietary needs. Use of computer techniques indicated that food expenditures were inadequate to support a

physiologically-required minimum diet, although caloric requirements were satisfied.

In planning adequate nutritional diets suitable for British dietaries, Vajda (1958) set requirements of 75 g protein, 90 g fat, and 300 g carbohydrate, which were met from a list of 8 foods. A computer planned a daily diet that included steamed fresh haddock, national wheat-meal bread, and margarine.

Smith (1963) described the "Beckman Model" which in 1959 computed a minimum cost subsistence diet for a 45 year old male. Nutritional values were based on recommended dietary allowances in 1958. The solution of the problem was checked for amino acid requirements. A list of 25 foods was used, from which the following foods were selected to satisfy requirements: lard, fresh orange juice, beef liver, soy bean meal.

Adequate Nutritional Diets. In another study reported by Smith (1963), 4 diet models were designed in an effort to formulate descriptive models for British working class diets. Fifteen groups of foods were listed, at average prices for each group. Tight restrictions resulted in a diet plan with large excesses of bread and potatoes. When restrictions were relaxed, diets simulated by computers included vegetable and cereal groups. Compared with actual diets of British working class, the modified model included all food groups except fruit.

The "Smith Midget Model" was a diet planned by computer to fulfill nutritional needs over 28 days for a family of 3. Food lists were selected from a report of actual food purchases of 76 Michigan families. The Midget Model listed fresh homogenized milk, oleomargarine, carrots, potatoes, picnic ham, and white flour, to fulfill requirements.

Subsequent efforts by Smith to produce a minimum cost diet that would achieve recommended nutritional values sought to increase palatability. Application of "conventional restraints" helped force diets into more conventional and acceptable form. These restraints were (1) defining maximum limits that prevented satiation, (2) defining minimum limits that insured that food preferences were not ignored, (3) "complementarity restriction" that allowed some foods to be more palatable in combination than when eaten alone. Further "cooking aids" such as baking powder, baking soda, flavoring extracts, vinegar, and prepared mustard were allowed to enter the original list. These raised cost and increased palatability without contributing to nutritional value. When more foods were added to the Midget Model list, costs rose and modification of amounts of foods took place (Smith, 1963).

Intended to be reasonably palatable, a larger model used a list of 572 foods, provided for coffee and condiments, demanded that certain nutritional needs be met at least cost, and applied the restraints of the previous models. With this model, the computer met prescribed nutritional

requirements at a cost of $43.96 for 3 people for 4 weeks. Prices were based on those in Michigan in May, 1955. Cost per person per meal for the computer-planned diet was less than 17½¢, whereas in a consumer survey at that time, no family who spent less than 20¢ per person per meal achieved recommended nutritional levels (Smith, 1963).

Nonselective Hospital Diets. Mathematical designs for computer system menu planning have been studied. Balintfy and Blackburn (1964) reported a successful attempt in formulating nonselective low cost, nutritious diets for hospital patients. Data processed by the computer included nutrients, costs based on yield adjustments, standardized recipes, serving portions, and patient preferences (Balintfy and Balintfy, 1965). A paper by Balintfy and Nebel (1965) described experimental procedures followed for evaluation of problems and results arising out of trial menus planned by computer. A panel of dietitians evaluated menus prepared by different methods and indicated general acceptance of computer-planned diets. Balintfy and Blackburn (1964) quoted cost savings of up to 30 per cent, using computer menu planning techniques.

Balintfy and his co-workers are proceeding in their development of mathematical models to aid computer menu planning. The random nature of nutrient composition of menu items, lack of predictability in menu selection, and differences in nutrient intake requirements were problem areas encountered by Balintfy and Prekopa (1965) in attempts

to formulate accurate and comprehensive mathematical models for menu planning.

Selective Hospital Diets. An attempt to adapt methods of mathematical programming and digital computers to planning selective menus for hospital patients was reported by Gue (1965). Results from an exploratory study indicated success in adaptation of Balintfy's nonselective menu planning methods. Emphasis was placed on adequate nutrition; 9 nutrients were considered. Provision of choice from each menu class was sought. Variation in menus was a third criterion. Cost savings were not as dramatic as those proposed by Balintfy and Blackburn (1964), but because of random selection of menu items by patients, Gue (1965) found them difficult to predict. According to this report for each meal the computer calculated the combination of menu items with lowest possible nutritional content, and the probability of such a selection.

Other Computer Applications in Food Service

In 1964 Hartman observed that 600 hospitals were using data processing techniques, and suggested that dietitians study potential of computer applications for management of food services. Advantages of computers as a tool of management, stated Hartman (1964), were accuracy of machine calculation, saving of professional time, and an increased depth of information from detailed analyses that could

become available with no additional manpower expenditure once initial data were assembled.

Three stages of applications of electronic data processing in management practice were cited by Hertz (1965). The first stage was replacing manual clerical tabulation processes with computer techniques. Second was utilization of electronic data processing in management analysis. The third stage of application was use of operations research and systems analysis in decision-making and problem-solving by computers at managerial level.

Stage 1. Application of Tabulation Processes. At least 1 hospital used a computer to count menu item selection (Balsley, 1964). Savings in man hours, increased accuracy of tabulations, less food wastage, and more efficiency in tray assembly were noted as advantages.

Stage 2. Application of Management Analysis. The next stage in applying computer techniques to management involved development of new types of information. Detailed analyses and reports previously unavailable because of time involved in preparation, could be provided frequently by computers (Fellers and Gue, 1965). Food service applications include nutrient analysis, labor cost analysis, inventory control, and food cost analysis.

Nutrient Analysis. Veterans Administration hospitals have been using computer techniques to check nutritional adequacy of manually-planned diets since 1962, disclosed Brisbane (1964). Basic data on food codings and 14 nutrients

were provided for each food on punch cards. Knowledge of nutritional content of daily and weekly diets was improved greatly as a result, and manually-planned menus showed improvement in nutritional content. One data processing center analyzed information for 28 hospitals during a test period, and Brisbane (1964) said that the system could be implemented in 170 hospitals throughout the nation.

Labor Cost Analysis. A system for analysing labor costs in a food service was described by Balsley (1964). Time spent in specific task areas of food service were calculated by a computer. Information useful to management was provided concerning labor costs and calling attention to areas of excessive cost.

Work Sampling. Work sampling was another application discussed by Balsley (1964). Tasks in different areas of a cafeteria were coded. Observations were punched on 29,000 cards and processed by computer. Results were classified by the computer showing activity time, time spent by each employee in each type of activity, and total time in each area at each hour of the day.

Inventory and Food Cost Control. Seventy-nine institutions under control of the Commonwealth of Pennsylvania utilized computer control to improve food service (Taylor, 1965). Aims of the system were adequate nutrition, economy of diet, determination of accurate budgetary requirements, and maintenance of cost controls. Nutritional values and cost of food were calculated for each institution. Machine

analysis made it possible to compare food costs within and between institutions. Depth of information made available enabled closer control of food usage, budget management, and a general insight into efficiency of food service operations.

Another hospital analyzed food purchase orders and costs which were compared with kitchen consumption. A close check on food inventory resulted (Balsley, 1964). Food cost analysis included total cost, costs by food category, and cost per meal.

At the University of Missouri, a computer monitored the perpetual inventory system. Total daily food costs were made available (Ohio State University conference notes, 1965).

Stage 3. Application of Decision-Making and Problem-Solving. The third stage of computer application to management practice, and probably the most useful, was that of decision-making and problem-solving (Hertz, 1965). However, in the food service industry little has been accomplished in this area (Fellers and Gue, 1965).

Cafeteria Simulation. Knickreim et al. (1963) studied the possibilities of the simulation of cafeteria service lines by a computer. A mathematical model was established to determine effects of changes in layout, or operating procedures, on time customers spent waiting for service. Effects of these changes were determined also for dining room seating patterns. The technique could be used to

ensure optimum utilization of cafeteria facilities and personnel.

Total Dietary Systems. Reports by Fellers (1965), and Fellers and Gue (1965) indicated that total computer control of a dietary system was feasible. Installation of such a system would depend on computer-planned menus, as menus and recipes are the basis of all other activity in food service operations. Under such conditions, computers would control inventory, food specification and purchasing, work assignments, and equipment scheduling. Preparation instructions would be issued by computer also.

A food service system was envisioned by Casbergue (Ohio State University conference notes, 1965) in which computers would be used for menu writing; recipe calculation; tallying patient's selections; purchasing and forecasting costs and supply needs; ordering of supplies from storeroom for kitchen consumption; scheduling food production, equipment, and work load; and provision of cost and nutritional data. He stated that development of menu planning by computer had reached a more advanced state than had use of computer control in production and management aspects of food service systems.

PROCEDURE

Selection of Menu Items

Foods used in the spring semester of 1965 by the residence hall food services of Kansas State University were the basis for menus to be planned by the computer. These foods were obtained from the actual menus used during that period.

Menu Analysis. The menus were analyzed for the following classes of foods: dinner entree, potato, vegetable, dinner salad, dinner dessert, lunch entree, lunch salad, lunch dessert. Different menu items used in this period for these classes were noted and the number of times that each was served was tallied. The weeks in which each item was served were observed, so that some indication of frequency intervals between appearances of a particular food on the menu could be obtained.

Breakfast. Breakfast in the residence hall food services was a relatively stable meal pattern featuring juice, hot and cold cereal, usually an egg in some form, toast, jelly, and beverage. Therefore, for the purposes of this study, the decision was made to omit this meal and the foods it utilized.

Lunch. Lunch featured a selective menu. Although juice, soup, vegetable, or potato often was served, no pattern seemed to be associated with the use of these items on the menu. In order to standardize the problem,

these foods were eliminated from consideration. For lunch during the period checked, a total of 74 entrees, 74 salads, and 73 desserts was used. Thirty-seven salads appeared on lunch and dinner menus (Appendix A, Table 5).

Dinner. For dinner, selection was limited to salad and dessert. During the semester surveyed, 52 entrees, 16 variations of potatoes, 41 vegetables, 82 salads, and 72 desserts were counted on the menus. As previously noted, 37 of the 82 salads also were found in the lunch list (Appendix A, Table 5).

Standardized Recipes. In order to have standard recipes from which to work for costing purposes, "Food for Fifty" by Fowler, et al. (1961) was used as a point of reference. Only those menu items for which recipes appeared in this book were considered for computer input. From this shortened list of menu items, a selection was made for computer input (Appendix B, Form 1). To simplify the problem, 21 menu items were chosen arbitrarily for each of the following classes: lunch entree, dinner entree, vegetable, lunch dessert, and dinner dessert. Thirteen of the 16 potato variations appearing on the residence hall menus were listed for computer input. One list of 34 salads was obtained by randomly selecting 21 salads from each of the lunch and dinner lists (Appendix A, Table 5), and then eliminating duplications.

Menu Structure

Balintfy and Blackburn (1964) developed a method of calculating nutrients and cost for nonselective hospital menus planned by computer. Because the dietary intake of college students eating in residence hall food services cannot be controlled, the decision was made to define a menu structure that would ensure adequate nutrition if all foods in the pattern were selected and eaten in a 24 hour period.

Nutritional Requirements. The U. S. Department of Agriculture (1964) recommended that the Basic Four food groups be used to form a foundation for an adequate North American diet (Appendix B, Form 2). Using this guide, at least two servings from the meat group, four servings from the fruit and vegetable group, four servings from the bread and cereals group, and a milk allowance varying according to sex and age, should be included in the daily diet.

Although breakfast was not included in this study, it may be assumed to consist of at least one serving from the fruit and vegetable group, one serving from the bread and cereals group, and possibly one serving from the meat group. Milk allowances were disregarded in this study, since milk is available for drinking to students eating in the residence hall food services at all three meals. Also, a certain amount of milk would be incorporated into the cooking or preparation of some menu items. Thus, food

allowances remaining to be satisfied would be two servings of meat or substitute, a minimum of three servings from the fruit and vegetable group, and at least three servings from bread and cereals group.

Menu Pattern. The basic menu pattern used in the Kansas State University residence halls at the time of this study was followed with some modification. In order to simplify and standardize the menu pattern for computer programming purposes, five items were set for dinner, and three menu items were set for lunch (Table 1). Beverages and bread were not included. The outlined menu structure would give a total of two servings of meat or substitute, at least four servings from the fruit and vegetables group, and at least three servings from bread and cereals group. When breakfast menu pattern is added, the menu structure should fulfill all requirements of the Basic Four, except that of milk.

Input Data

For this study, the input data included only palatability factors, costs, frequency ratings, and menu classification. No attempt was made to add descriptive terms to the basic menu items. Palatability factors used were texture, flavor, color, shape, and variety as denoted by preparation method.

Palatability Coding. Numerical codes were assigned to food items in an attempt to describe those elements of foods recognized by human senses. Foods were coded

Table 1. Menu structure for meals planned by computer.

Meal	Food group	Menu item classification	
		Name	Code
Breakfast	(Not included in computer planning)		
	Fruit and vegetable	Fruit juice	not included
	Meat or substitute (fish, poultry, egg)	Egg	not included
	Bread and cereals	Cereal	not included
	Bread and cereals	Toast	not included
Lunch	Meat or substitute (as above)	Lunch entree	5
	Fruit and vegetable	Lunch salad	3
	Bread and cereals or fruit and vegetable	Lunch dessert	6
	Bread and cereals	Bread item	not included
Dinner	Meat or substitute (as above)	Dinner entree	1
	Fruit and vegetables	Potato	7
	Fruit and vegetables	Vegetable	2
	Fruit and vegetables	Dinner salad	3
	Bread and cereals or fruit and vegetables	Dinner dessert	4
	Bread and cereals	Bread item	not included

according to palatability factors of texture, flavor, color, shape, and variety described by preparation methods.

Texture. Initially, 5 characteristics were devised for texture rating as follows: (1) soft; (2) chewy, crunchy, or crisp; (3) medium texture; (4) food served with sauce, gravy, or dressing; (5) liquid. Further definition of characteristics for texture ratings proved necessary. Soft foods were distinguished from very soft foods, and medium texture was differentiated into moderately chewy. The liquid characteristic was eliminated as this was not used in the present food listings. A total of six categories for texture characteristics resulted (Table 2).

Table 2. Index to palatability codings of menu items.

Palatability factor	Characteristic 1	2	3	4	5	6	7
Texture	soft	chewy crisp crunchy	medium texture	sauce over food	very soft	moderately chewy	
Flavor	sour bitter	strong spicy	meat fish poultry cheese	bland	sweet	savory vegetable	
Color	white	brown	orange yellow golden	green	red pink	mixed	purple black dark blue
Shape	round oval	square	sticks shreds long forms	diced	wedges	no definite shape	slices
Preparation method	boiled steamed	fried	baked	roast	grilled broiled	raw	cold

Flavor. Six characteristics of flavor were defined: (1) sour or bitter; (2) strong, spicy; (3) flavors related to protein foods (meat, poultry, fish, cheese); (4) bland; (5) sweet; (6) flavors of vegetable nature (Table 2).

Color. Seven characteristics were assigned for color: (1) white; (2) brown and grey-brown; (3) orange, yellow, and golden; (4) green; (5) red, pink; (6) mixtures of colors; (7) purple, dark blue, and black (Table 2).

Shape. Originally 6 characteristics were assigned for shape. These were (1) round or oval; (2) square; (3) shreds, sticks, or long, narrow forms; (4) diced; (5) wedges; (6) liquid. A seventh characteristic was added for slices (Table 2).

Preparation method. Methods of preparation were coded as follows: (1) boiled, steamed, and other moist heat methods of cookery; (2) fried; (3) baked; (4) roasted; (5) grilled and broiled; (6) raw; (7) cold, chilled, and frozen (Table 2).

Coding problems. Where two distinct characteristics fell within the same factor, the more dominant attribute was chosen; e.g. ice cream and chocolate sauce were color coded brown. Garnishes were ignored. Coding for shape was sometimes difficult, as in fried chicken. Any food that was served with a sauce or gravy was placed in texture characteristic code 4 (foods served with sauce or gravy). The texture of solid food in such combinations was

disregarded, so that a predominance of gravies and sauces might be avoided in one meal, or in a day's meals.

Costs. Costs were estimated from recipes in "Food for Fifty" by Fowler et al. (1961). Using current institutional prices, total cost for each recipe included on the final food list was calculated and divided by 50 to give the cost per serving which then was entered on data cards.

Frequency Ratings. All menu items from lunch and dinner menus of the spring semester, 1965, menus were listed and circulated to dietitians in the residence halls (Appendix B, Form 3). They were asked to indicate whether they considered a menu item sufficiently popular among students to be served once every 2, 4, 8, 16 weeks (once a semester), or never. Fifteen dietitians cooperated in the survey. Frequency opinions were tabulated, and a rating for each menu item was established according to how often the majority of opinions indicated each menu item should be served (Appendix A, Table 5).

Frequency ratings were assigned as follows: 2 indicated that the menu item could be served once every 2 weeks; 4, 4 weeks; 8, 8 weeks; and 16, 16 weeks. Thus the frequency rating stated the time lapse between appearances of the same item on the menu. This information was entered on data cards.

Menu Classification. Each menu item was assigned a number corresponding to its place in menu structure, e.g. roast beef was a dinner entree; tossed salad, a salad; and

chocolate cake, a dinner dessert (Table 1). The computer was programmed so that 1 item from each menu classification would be selected for 1 day.

Evaluation of Menus

The computer planned a day's menu consisting of lunch and dinner as one menu. Subject to certain restrictions, 8 menu items were selected and sorted into 3 for lunch and 5 for dinner. To evaluate the computer planned menus, therefore, both lunch and dinner had to be considered together.

Menus for 7 days (Table 3) were selected from 21 menus planned by computer (Appendix A, Table 6). Because dinner entrees were the menu item around which an entire day's menu was planned, selection of computer menus for evaluation was based on variety in dinner entrees. Representation of different meats, meat cuts, and meat substitutes was sought.

Residence hall menus for the 1965 spring semester were used to evaluate the computer-planned menus. From these menus, 2 meals having entrees identical to the selected 14 computer-planned meals were chosen. Three menus having identical entree items, 2 from residence halls and 1 computer-planned, were put together in random order. In all, 14 dinner and 14 lunch menus were taken from the residence hall menus. All menus were uniform in appearance making identification of origin impossible.

Table 3. Menus selected from computer output for evaluation.

Menu	Palatability codes					Cost per portion	Meal cost
	T	F	C	S	PM[a]		
Menu 1							
Ham Salad Sandwich	1	3	5	2	7	.10	
Rhubarb Mold	1	5	5	2	7	.03	
Gingerbread with Topping	1	2	2	2	3	.03	
							.16
Barbequed Chicken	3	2	2	1	3	.29	
Parsley Buttered Potato	3	4	1	1	1	.02	
Baked Squash	5	4	3	1	3	.04	
Cabbage Salad	2	6	4	3	6	.01	
Lemon Chiffon Pie	5	2	3	5	7	.03	
							.39
Menu 2							
Creole Spaghetti	4	2	2	6	3	.09	
Cucumber in Sour Cream	4	6	1	7	6	.05	
Spice Cake	1	2	2	5	7	.03	
							.17
Pork Cutlet	3	3	2	1	3	.28	
Scalloped Potato	4	4	1	7	3	.04	
Whole Kernel Corn	6	6	3	4	1	.05	
Pineapple, Marshmallow, Grape Salad	6	5	3	4	6	.08	
Strawberries and Cookie	2	5	5	1	7	.10	
							.55
Menu 3							
Grilled Cheese Sandwich	2	3	2	2	5	.05	
Egg Slice and Asparagus Salad	3	6	6	3	7	.16	
Chocolate Chip Cookie	2	5	2	7	3	.03	
							.24
Roast Turkey	3	4	1	7	4	.29	
Franconia Potato	3	4	2	1	4	.02	
Lima Beans	6	6	4	4	1	.05	
Macaroni Salad	4	4	1	1	7	.08	
Lemon Chiffon Pie	5	2	3	5	7	.03	
							.47
Menu 4							
Corned Beef Sandwich	3	2	5	2	7	.13	
Tomato and Cucumber Salad	2	6	3	7	6	.04	
Oatmeal Fruit Bar	6	5	3	5	7	.02	
							.19
Ham Loaf	1	3	5	2	3	.16	
Mashed Potato	5	4	1	1	1	.02	
Buttered Peas	3	5	4	4	1	.05	
Tossed Salad	2	6	6	4	6	.04	
Chocolate Cake-Fluffy Icing	1	5	2	5	7	.03	
							.30

Table 3 (concl.)

Menu	Palatability codes					Cost per portion	Meal cost
	T	F	C	S	PM[a]		
Menu 5							
Cheese Souffle	5	3	3	2	3	.06	
Celery and Beet Salad	2	6	5	1	6	.06	
Baked Apple	5	4	2	1	3	.07	
							.19
Roast Beef	3	3	2	7	4	.32	
Creamed Potato	4	4	1	1	1	.03	
Harvard Beet	4	2	5	3	1	.08	
Applesauce Mold	1	5	4	2	7	.04	
Frosted Brownie	3	5	2	2	7	.06	
							.53
Menu 6							
Bacon, Lettuce, and Tomato Sandwich	2	6	6	2	7	.14	
Lime Gelatin and Pear Salad	1	5	4	2	7	.05	
Fudge Pudding	4	5	2	2	3	.05	
							.24
Baked Sole in Tomato Sauce	4	3	5	3	3	.16	
Franconia Potato	3	4	2	1	4	.02	
Baked Squash	5	4	3	1	3	.04	
Relishes	2	6	6	3	6	.03	
Lady Baltimore Cake	1	5	1	5	7	.05	
							.30
Menu 7							
Pizza	2	2	5	5	3	.10	
Tomato and Cucumber Salad	2	4	3	7	6	.04	
Apricot Whip	5	5	3	1	7	.02	
							.16
Swiss Steak	4	3	2	2	3	.28	
Parsley Buttered Potato	3	4	1	1	1	.02	
Asparagus	3	6	4	3	1	.14	
Pickled Beet Salad	3	2	5	1	7	.07	
Angelfood Cake and Strawberries	5	5	5	5	7	.02	
							.53

[a] T texture
F flavor
C color
S shape
PM preparation method

Lunch and dinner menus were listed separately for purposes of evaluation (Appendix B, Form 4). Residence hall menus did not show combinations of dinner and lunch entree items in same sequence as that of computer-planned selection.

Dietitians evaluating the menus were asked to score palatability aspects of each menu. A 5 point rating scale was used: 1 equalled unacceptable combination or variety of foods and 5, excellent combination or variety of foods (Appendix B, Form 4). Evaluators were asked to indicate for each set of 3 menus which had the most pleasing combination of menu items.

Scores on returned forms were tabulated. Average ratings for each characteristic were calculated for the individual menus. Preference ratings were tallied to establish the menu in each set that was considered by dietitians to be the most pleasing combination of menu items.

Description of Program

The program for menu planning was written in Fortran language for an IBM 1410 computer in the Computing Center at Kansas State University. To write 1 day's menu including lunch and dinner, 8 selections were made (Appendix B, Form 5).

The program relied on random selection techniques, through generation of random numbers. Input consisted of menu item names that were read in as 7 menu item groups.

A blank card separated each group. The 7 menu categories were entered into computer storage as rows of a matrix. Dinner menu items occupied rows 1 through 21. Subsequent menu item groups followed; 1 row of the matrix was used for each menu item.

Selection of Menu Items. To select an item from the dinner entree list, a random number was generated. Since dinner entree items occupied rows 1 through 21, the number computed had to be within this range. If the random number was outside these limits, random number generation processes were continued until an acceptable number was found. In order to be usable, the random number had to be within maximum and minimum row number limits for each menu item list. The process was repeated for the eight selections necessary to make up a day's menu.

Menu items were selected in the following order: dinner entree, lunch entree, dinner potato, lunch dessert, dinner dessert, dinner vegetable, dinner salad, and lunch salad. Salads were placed last in the selection order, as they were a menu item group with a high range of variability in texture, flavor, color, and shape characteristics. As each selection was made, the possibilities of selecting any menu item that fell within restrictions placed in the program sharply decreased. Desserts, as a menu item group showed little range of variation in characteristic codings (Appendix B, Form 1). When lunch and dinner desserts were last in the selection order, variation was difficult to

obtain in dessert items. Dessert selection showed improvement when order of selection was changed.

Checking for Conflict. Eight selections were made to form a day's menu. Within 8 selections, any 1 characteristic code could appear a maximum of 3 times for each palatability factor. In 1 day up to 3 red, 3 soft textured, 3 square shaped menu items, and so on could appear.

As each selection was made, characteristics codes for the particular selection were entered in a "conflict matrix" in which columns could be scanned for appearance of a characteristic code more than 3 times. The first 3 menu selections did not need to be checked as no conflict could arise. The remaining 5 menu items each had to be examined for conflicts against previously chosen menu items. If a conflict existed, the menu item immediately following a conflicting selection was compared for conflicts. This process was repeated through the entire list if necessary, until a non-conflict item was located. If no non-conflict item was found the computer entered zeros, and proceeded to the next menu item list where selection and checking processes were repeated.

A further restriction was placed on dinner entree and lunch entree items, stipulating that each menu item in these lists could be used only once. When selection was made, the program instructed that that menu item be eliminated from the list. A similar instruction was placed on

salads, whereby a salad selection could not reappear within 3 days.

Output. Menus were printed out with menu items arranged in conventional order, viz., lunch entree, lunch salad, lunch dessert, dinner entree, potato, vegetable, dinner salad, and dinner dessert. A blank space appeared between lunch and dinner menus. All characteristics codes were included in output, and costs were printed with totals presented for each meal. No daily total costs were given (Appendix A, Table 6).

This program selected 21 menus, the limit of dinner entree items and lunch entree items. Time for selection of these menus was 6 minutes.

RESULTS AND DISCUSSION

Twenty-one menus were planned by computer (Appendix A, Table 6), from which 7 were selected for study and analysis (Table 3). Computer printout consisted of lunch menus followed by dinner menus; each menu was costed. No daily total cost was given, although such a total could be provided within the scope of the present program.

Menu Structure

The program chose and combined menu items by means of a random selection technique. Thus, on rare instances when traditional combinations and patterns of foods showed in computer output, it was due to chance.

The limited number of menu items used as data in this study restricted the choice available for computer selection. As each day's menus were planned, selection lists became subject to elimination of some items and restriction on use of other items, therefore decreasing possibilities of optimum considerations. Final output should be improved by augmented food lists. Even though not included in actual menu planning, fixed menu items served at each meal, such as breads and beverages, should appear in the printed output. Allowance should be arranged for the nutritional contribution and cost of these foods to daily meals.

Nutritional Requirements. Dietitians must ensure that adequate, nutritious meals are served in all food services. Although exact computations of daily nutritional intakes may be desirable in hospital meal planning, this was not considered necessary for residence hall food services. In residence halls, assurance of adequately nutritious meals may be achieved satisfactorily through establishment of a meal pattern that fulfills daily requirements of the U. S. National Research Council for adequate nutrition (1964). Stated in more popular terms by the U. S. Department of Agriculture (1964), the daily recommended allowances may be fulfilled by the Basic Four Food Groups (Appendix B, Form 2). This system could be used in all situations other than those where a record of definite nutritional intake is needed. However, an addition to the computer program

enabling occasional spot checks of specific nutrient intakes provided by residence hall diets would be desirable.

Palatability Coding

No attempt was made in this study to numerically describe menu items on the basis of unique attributes. For example, the computer could not differentiate between a pork chop, pork cutlet, or roast pork. Therefore, repetition of the same type of food could occur in consecutive menus. At the present stage of computer development, perceptive power of the machines is limited by a specific method of programmed instruction. Either the present program must be refined or some other means must be found to describe foods and menu items. When this has been done, problems of repetition of similar foods would be overcome and more variety attained.

Texture. Decisions concerning numerical description of textures of different food items was difficult and requires further development. More categories must be created for texture characteristics in order to provide sufficient scope for computer selection within restrictions placed in the program. However, when the original 5 texture characteristics were further broken down to give 7 texture codes, menus showed a trend toward monotony in texture, because of fine distinctions involved in breaking down broader classification groups. The computer was not programmed to recognize minor differences between soft and

very soft characteristics, and could select up to a maximum of 6 menu items in these 2 characteristics, 3 from the soft group, and 3 from the very soft group, without violating restrictions (Table 3, Menu #1).

Flavor. For purposes of this study, flavor characteristics were adequate to enable the computer to make selections within restrictions of the program and yet maintain variety in output. Although 3 strong flavors could appear in 1 meal, this did not occur in output obtained. The only strong flavor combination occurred in the lunch meal planned with Creole Spaghetti and Spice Cake for dessert (Table3, Menu #2). The computer could choose a total of 6 bland and sweet foods in one day's meals; but in the 7 menus evaluated, only on 1 menu did a combination of 5 foods having these characteristics appear (Table 3, Menu #6). Excessive monotony of flavor of foods does not occur readily in North American diets because of the variety of foods available and the customary food pattern. Taste of food is a vital factor in food acceptance, and judgement of flavor is highly subjective.

Color. With the program used for this study, 2 difficulties might be encountered: color clashes between characteristics of red and yellow-orange, and/or lack of variety in color. For the same meal, the computer could select Harvard Beets and a Sliced Tomato Salad or Carrot Rings with Rhubarb Salad. When Chicken Salad was used for

lunch, 2 other white foods could appear on the menu. This could not occur in the dinner meal where 5 selections ensured at least two different colors.

Shape. Shapes of menu items selected by computer generally showed satisfactory variation. One problem related to round shapes. For portion control, foods are served frequently with a scoop. Also many foods that have a round form are sliced for the same reason. As a result of the manner of coding, Pork Cutlet, Mashed Potato, Peas, and Cherry Pie could be served in one meal. Cherry Pie has been coded as a wedge shaped food; but its components, cherries, are round in shape and retain their individual characteristics in this menu.

Recipes also may affect the shape of a menu item as in the case of Creole Spaghetti. If the ingredients hold together, this may be served with a scoop and assume a round shape; but if more liquid is used, the portions may be served with a ladle and not remain in a definite shape. Actual observation of menu items in food services may clarify many of these problems.

Preparation Method. Achievement of variety in preparation method did not prove difficult when planning menus by computer with emphasis on palatability. This factor would become more important if equipment capacity was to be incorporated into this program.

Coding Problems. Conflicting characteristics within the same factor in menu items pose a difficult decision.

At the present state of development in the program used in this study, only 1 digit has been made available for each characteristic. The use of 2 or more digits in describing characteristics subsequently might prove necessary. Problems in establishing upper bounds in the number of digits used in descriptions may occur. The number of digits has to be consistent for computer input and definition of this must be reached prior to further work.

Costs

The program did not place maximum or minimum limits upon cost factors. Because tallies of costs of each meal were provided by the computer, human appraisal of costs could rapidly eliminate menus considered to be above maximum desirable costs. Elimination of 1 menu in this manner should not affect remaining menus, as the computer planned each daily unit separately without regard to previous day's menus, or those of the following day.

Accuracy of cost data was not achieved in this study, and no allowance for cost of certain fixed menu items, breads, beverages, etc., was made. The program did not seek to balance high-cost menu items with low-cost menu items.

Frequency Ratings

Frequency rating data were not considered in programming restrictions, as the minimum lapse for frequency

ratings was 1 week and only 7 day's menus were planned in this study. Frequency rating data did not appear in the printed output because of lack of storage space in the processing unit of the computer. Fortran language, used in programming, utilizes computer storage for instructions concerning conversion of relatively simple program-writing formulae to detailed procedures for machine calculation. More storage space in the processor could be available if a different language were used, or if care were exercised in programming with Fortran to ensure economy of space.

Menu Classification Rating

Menu classification ratings were found to be superfluous for the method of programming used. As with frequency ratings not enough space was allowed in the computer to have the information printed out. However, programming methods ensured that menu items were selected from appropriate lists, which proved to be an efficient system. Menu classification ratings might ultimately have a use in the development of numerical descriptions of foods and menu items and would be necessary where computer applications were used as filing systems for recipes and accompanying data.

Menu Evaluation

Of 14 sets of 3 similar menus, 5 computer-planned menus and 9 dietitian-planned menus were preferred. Results

are summarized in Table 4. Each set of menus contained 1 computer-planned and 2 dietitian-planned menus for which to indicate a preference. Average scores for the 5 palatability factors (texture, flavor, color, shape, preparation method) were not always highest for the preferred menu. In dinner menu set E (Table 4), the second menu was preferred although characteristic ratings for that menu were highest only in the texture factor. In lunch menu set B (Table 4), the third menu was preferred. Average characteristic ratings for that menu were highest only in 3 characteristics, whereas the first menu was scored highest in 4 characteristics. In texture and shape characteristics the 2 average scores were the same (Table 4).

Ice cream appeared as a dessert on 4 menus. Three of these 4 menus were rated as preferable although in some "preferred" menus average scores for characteristics ratings did not always support the preference choice (lunch set B, lunch set C, Table 4, both featuring ice cream for dessert). One or 2 popular menu items featured in a meal might influence the judgment of a dietitian. Results of the evaluation used in the present study were considered at face value. Factors influencing individual menu judgments are complex and might be worthy of independent research.

Results of the evaluation favored menus planned by dietitians. Computer-planned menus in one third of the sets were judged more acceptable than those planned by dietitians.

Table 4. Tabulation of average ratings and preferences from menu evaluations.

Menu number		Palatability codes[a] T	F	C	S	PM[b]	Number of votes	Preferred menu
Dinner								
A	1	1.9	2.8	2.5	2.8	3.6	0	
	2	2.9	3.1	1.7	2.6	3.4	3	
	3*	3.6	3.7	3.7	3.4	4.0	13	X
B	1*	3.2	3.1	3.0	3.4	4.0	5	
	2	3.6	3.7	3.2	3.7	3.8	9	X
	3	2.8	3.3	2.5	2.9	3.2	2	
C	1	2.1	2.9	2.4	2.5	3.6	0	
	2*	2.2	2.3	1.9	2.6	3.3	1	
	3	4.1	3.8	3.9	3.9	4.0	15	X
D	1	3.1	3.3	3.4	3.1	3.5	5	
	2	2.4	3.2	3.3	3.1	3.1	2	
	3*	3.6	3.4	3.3	3.6	3.8	9	X
E	1	2.3	3.1	3.4	3.6	3.4	5	
	2	3.4	3.0	2.9	3.5	3.6	6	X
	3*	3.3	3.3	2.8	3.4	3.8	5	
F	1	2.9	3.1	3.4	3.4	3.5	1	
	2*	3.7	3.8	3.6	3.5	3.9	9	X
	3	3.8	3.6	3.4	3.4	3.6	6	
G	1*	2.5	3.1	3.2	3.0	2.9	5	
	2	3.4	3.3	3.4	2.8	3.6	9	X
	3	2.9	3.0	2.1	2.8	3.3	2	
Lunch								
A	1	2.8	2.8	2.6	3.1	3.4	1	
	2	3.8	3.9	3.5	3.6	3.9	14	X
	3*	3.1	2.3	2.9	3.3	3.4	1	
B	1*	3.7	3.6	3.3	3.6	3.8	7	
	2	2.7	3.1	2.8	3.3	3.3	1	
	3	3.7	3.4	3.4	3.6	3.6	8	X
C	1	3.3	3.2	3.0	2.9	3.4	9	X
	2*	2.9	3.1	2.5	3.1	3.4	5	
	3	2.1	2.9	2.6	3.0	3.1	2	
D	1	3.8	3.5	3.2	3.4	3.6	11	X
	2	2.4	2.2	2.3	2.5	2.8	1	
	3*	3.4	2.8	2.8	3.4	3.3	4	

Table 4. (concl.)

Menu number		Palatability codes[a] T	F	C	S	PM[b]	Number of votes	Preferred menu
E	1	2.6	3.2	3.1	3.3	3.5	2	
	2*	2.8	2.8	2.8	2.8	3.6	5	
	3	3.6	3.5	3.4	3.4	3.6	9	X
F	1*	3.4	3.7	3.6	3.4	3.8	10	X
	2	3.2	2.6	3.8	3.3	3.1	1	
	3	3.2	3.1	3.2	3.1	3.1	5	
G	1	1.9	1.9	1.5	2.1	2.9	1	
	2	1.8	2.2	2.1	2.8	2.9	2	
	3*	3.5	3.6	3.3	3.6	3.6	13	X

[a] Score key: 5 excellent combination of menu items
4 good combination of menu items
3 acceptable combination of menu items
2 poor combination of menu items
1 unacceptable combination of menu items

[b] T texture
F flavor
C color
S shape
PM preparation method

* computer-planned menu

Program

Despite the use of random selection techniques in programming, some measures of control over computer choices were available. The random number generator was given a 3 digit numeric argument that could be changed, resulting in a new set of menus. Another simple method of altering output was by changing the order of input cards. A change in programmed order of selection of menu items also would result in a different set of menus.

Restrictions placed on the computer selections had a definite influence over the output. Restrictions in the program related to characteristics of the menu items and the number of times that certain menu items could appear. If characteristics codings were changed, or if restrictions pertaining to the appearance of certain food items were extended or removed, different menus would result. Also, a maximum cost restriction would serve to alter the computer's choice, as would a restriction to minimize cost. Frequency ratings were not utilized. Extension of the program to cover a period of over 7 days would involve frequency restrictions. Additional restrictions thus introduced would again change the output. Provision of longer lists of input data would result in a different, and possibly improved computer selection.

Further Considerations

All food service systems contemplating conversion to computer control would require thorough and exhaustive analysis of their functions. Without comprehensive, accurate, and detailed knowledge of operations involved, automated techniques may create confusion. Quality output from a computer is directly dependent on quality of input. Food service operations are no exception to this rule. Another important factor in conversion to new managerial methods would be education of professional and non-professional personnel who would be involved in the operational functions.

Objectives of Menu Planning by Computer. The objectives of computer menu planning dictate the type of data required. The current study used the menu item name only, whereas a total electronic data processing system would be more likely to use recipe ingredients. Standardized recipe systems in conjunction with computer techniques could control such aspects of food service management as nutritional analysis, costs, serving size, food requisitioning from supplier or storeroom, work schedules, instructions for cooks, equipment use, and work load distributions. A comprehensive system would demand flexibility of program design to take care of fluctuation in costs, workers available, numbers to be served, as well as other variables.

Input Data. Much work remains to be done for the developmental stages of programming. Data gathered for the current study were neither accurate, comprehensive, nor representative for actual application. They served primarily to structure a programming model.

Costs. The ultimate cost of a menu item is more than the cost of its component ingredients. In an inclusive cost system, cost factors such as delivery charges, inventory, storage and preparation losses, labor, serving equipment, fuel, and maintenance would need to be calculated. The simplified program using only menu item names, in the beginning at least might be concerned with ingredient cost per serving only.

Palatability Coding. Coding categories developed for the study should be reviewed critically. A detailed study of menu composition would provide a more lucid basis for definition of menu item characteristics and subsequent coding. Where possible, decisions concerning assignment of codes should be objective rather than subjective.

Additional Studies. The psychological impact of food on the individual was not considered in the present study. Despite admonitions of menu planners to observe variation, harmony, and balance in texture, flavor, color, and shape of component items in planning a meal, reasons for this care are not widely reported in literature. Psychological reactions to color combinations, effects of monotony of aspects of texture, flavor, and shape, offer wide opportunity

for investigation in depth. Because of the need for precise appropriate data for input, computers are forcing food service management into realization of the present haphazard, piecemeal state of basic scientific information in the food service industry.

Additional Data. In order to attain total computer system menu planning, the breakfast meal should be included in programming. Nutritional adequacy cannot be assured unless all 4 food groups are included in menu planning. Therefore data on milk consumption should be assembled.

Breakfast Studies. Nutritional and cost values of the breakfast meal should be estimated in a university residence hall food service; numbers of each sex attending breakfast and type of food selected should be established, so that cost and nutritional allowances may be included in computer-planning of lunch and dinner. The alternative would be to add breakfast to the programmed menu selection.

Milk consumption. So that nutritional adequacy of computer-planned menus may be calculated, accurate milk consumption figures should be obtained. This would include not only milk used as a beverage, but that used in food preparation.

Student Attitude Studies. Information regarding student attitudes about food likes and dislikes and frequency of serving various menu items would be desirable. A simple method for ratings could be developed, whereby data processing methods could be applied to tally results.

Freshmen, a large group in the residence hall population, may undergo change in food habits and attitudes after exposure to residence hall food service. A lapse of time after commencement of the fall semester would allow familiarization with food served and consolidation of attitudes, thus yielding more useful results for frequency ratings. Popularity of foods may be estimated by observation of food consumption from serving lines and plate waste in the dishroom.

SUMMARY

Automation and data processing techniques have been accepted by many major industries and recognized as a force changing methods of management. Administrative capabilities have been extended because these management tools perform highly repetitive tasks in a minimum of time. In the past, the food service industry has been slow to accept new management applications. However, it is facing an acute shortage of management personnel and should be receptive to the implications of computer potentialities.

Menu planning is an example of a repetitive, time-consuming task of food service management. Recently, linear programming techniques have been developed to plan economical, nutritionally-adequate diets on a computer. Other factors such as texture, flavor, color, and shape of foods are important considerations in the planning of good menus.

The storage capabilities, or memory, of the computer should make it a valuable instrument in menu planning.

Emphasizing palatability, an approach to planning menus suitable for residence halls was attempted on a computer using random selection techniques. Data used for computer input consisted of selected menu items served in residence halls at Kansas State University, raw food costs, serving frequency ratings, and menu item classification. Each menu was coded with a 5 digit number related to texture, flavor, color, shape, and method of preparation. Restrictions were placed on the number of times that each characteristic could appear in one day, and on the appearance of certain classes of menu items. Recommended nutritional allowances were fulfilled by establishing a menu pattern compatible with recommendations of the U. S. Department of Agriculture (1964). Each day's menu included lunch and dinner meals only.

Menus for 21 days, using 152 menu items in each of 7 menu classes were planned. From these 21 menus, 7 were selected for closer evaluation. Each of the 7 computer menus was compared with 2 residence hall menus featuring the same entree by a panel of dietitians. Preference for computer-planned menus was indicated in 5 out of 14 instances.

The menus presented as computer output demonstrated that approaches to menu planning by computer through aspects of palatability and use of random selection techniques were

feasible. However, palatability codes will require further development and refinement, and selection lists for menu items will need expansion in order to improve output.

CONCLUSIONS AND RECOMMENDATIONS

Under the conditions of this study, techniques of random selection appeared feasible for planning nonselective menus by computer for university residence hall food services with emphasis on the palatability factors of texture, flavor, color, shape, and preparation methods of foods. Procedures used need refinement of input and output format. If the menu planning program designed for this investigation either is to be developed further, or modified, the following general recommendations should be considered.

1. Comprehensive objectives for the use of electronic processing as a tool of management in a residence hall food service system should be established.
2. A total system of electronic data processing should be designed to include menu planning, recipe information, purchasing procedures, inventory control, food production management, and fiscal controls.
3. A system of record-keeping and information retrieval should be designed to supply accurate

and appropriate data to be used for programming and input data.

4. An educational program should be developed to orient residence hall food service management in the advantages and use of such systems.

Specific recommendations for realistic application of the program developed in this study for residence hall food services are as follows:

1. Selection lists for menu items should be expanded, based on standardized recipes with descriptive names.
2. Refinement, expansion, and definition of characteristic codings is essential.
3. All aspects of costing should be thoroughly investigated.
4. Cost and nutritional allowances for fixed menu items (breads, spreads, condiments, beverages) should be included in the programmed output.
5. Breakfast meals should be included in a complete menu planning system.
6. Milk usage should be investigated and included in a complete menu planning system.
7. Student attitudes toward food should be determined.

Finally, total implications of the introduction of computer techniques into dietary management should be considered. Some authorities warn of the dangers of incoordinated research in food service management and urge that

standardization of coding on a national scale should be undertaken. If this is not done, masses of unrelated data will be developed, wasting valuable research effort and confusing ultimate goals.

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APPENDIX A

Table 5. Menu items from residence hall menus, spring semester, 1965, and frequency ratings.

	Dinner entree items	FR[b]
1	Roast Turkey*[a]	4
2	Baked Chicken	4
3	Barbequed Chicken*	4
4	Chicken Cutlet	8
5	Cornflake Chicken	4
6	Oven-fried Chicken*	4
7	Antoines Chicken Creole	16
8	Chicken Giblets	16
9	Oklahoma Chicken Loaf	16
10	Baked Chicken Leg and Thigh	4
11	Roast Beef*	2
12	Pot Roast of Beef*	4
13	T-Bone Steak**	8
14	Chopped Round Steak	4
15	Steak**	4
16	Minute Steak	8
17	Meat Loaf*	4
18	Baked Flank Steak	8
19	Brunswick Stew	8
20	Smothered Steak*	4
21	Salisbury Steak	4
22	Swiss Steak*	4
23	Beef Pot Pie*	8
24	Turnovers with Gravy	8
25	Pizza*	4
26	Porcupine Meat Balls	8
27	Swedish Meat Balls*	8
28	Italian Spaghetti	4
29	Liver with Onions*	8
30	Smoked Knackwurst	16
31	Roast Pork**	4
32	Pork Cutlet*	4
33	Pork Chop*	4
34	Butterfly Pork Chop	4
35	Baked Ham*	4
36	Ham Loaf*	4
37	Glazed Ham Patty**	16
38	Barbequed Spareribs*	8
39	Lamb Chops**	16
40	Veal Cutlet**	8
41	Barbequed Veal Chops*	8
42	Veal Fricassee*	16
43	Veal New Orleans	8
44	Baked Sole in Tomato Sauce*	16
45	Shrimp Jambalaya	16
46	Halibut Steak*	16
47	French-fried Groper	16
48	Catfish with Lemon*	4
49	Fried Perch**	4
50	Fisherman's Feast	8
51	Swordfish**	16
52	Baked Haddock	16

	Potato or substitute	
1	Whipped (Mashed)*	2
2	Rissole Potato*	2
3	Creamed Potato*	2
4	French-Fried Potatoes*	2
5	Potato O'Brien	4
6	Oven-browned Potato*	2
7	Parsley Buttered Potato*	2
8	Scalloped Potatoes*	4
9	Jacket Potato*	2
10	Tater Tots	2
11	Potato au Gratin*	4
12	Franconia Potato*	2
13	Hash-Brown Potatoes*	4
14	Rice*	4
15	Green Rice**	8
16	Sweet Potato*	4

	Vegetable items	
1	Buttered Green Beans*	2
2	Canned Beans**	2
3	Wax Beans*	4
4	Creamed Beans	16
5	Lima Beans*	8
6	Lima Beans and Brocolli	0
7	Succotash**	8
8	Whole Kernel Corn*	2
9	Scalloped Corn*	8
10	Brocolli*	4
11	Spinach with Vinegar*	8
12	Wilted Spinach*	8
13	Peas*	2
14	Continental Peas	2
15	Turnip and Peas in Cream**	16
16	Peas and Onions*	16
17	Boiled Baby Onions*	16
18	Creamed Onions**	8
19	French-Fried Onions*	4
20	Sauerkraut**	16
21	Buttered Mixed Vegetables*	2
22	Harvard Beets*	4
23	Beets in Orange Sauce**	8
24	Brussel Sprouts*	4
25	Celery**	8
26	Parsnips**	16
27	Carrots*	2
28	Candied Julienne Carrots*	4
29	Asparagus*	4
30	Scalloped Asparagus	16
31	Rutabaga**	16
32	Hominy**	16
33	Zucchini**	16
34	Squash*	8
35	Sweet and Sour Red Cabbage	16
36	French-Fried Cauliflower**	16
37	Vegetable Timbales**	8
38	Grilled Peach	4
39	Buttered Apple*	8
40	Broiled Tomato*	8
41	Stewed Tomato	4

	Dinner dessert items	
1	Karet German Spice Cake	4
2	Spice Cake with Coconut Pecan Frosting	4
3	Spice Cake with Burnt Sugar Frosting*	4
4	Angel Food Cake (AFC) with Chocolate Frosting**	4
5	AFC with Strawberries*	4
6	AFC and Lemon Sauce**	8
7	Chocolate Cake with Fluffy Icing*	4
8	German Chocolate Cake**	8
9	Pineapple Cashew Cake**	8
10	Cherry Glaze Cake	4
11	Marble Cake*	8
12	Lady Baltimore Cake*	4
13	Lemon Coconut Cake	8
14	Yellow Cake with Chocolate Icing**	4

[a] Key - * Items chosen for computer input
** Items with recipes in "Food for Fifty"

[b] Frequency Ratings

Table 5. (cont.)

	Dinner dessert (cont.)	FR
15	White Cake with Green Icing*	16
16	Brownies with Icing*	2
17	Lemon Cake Pudding**	8
18	Pear Ginger Upside-down Pudding	16
19	Apricot Upside-down Pudding**	16
20	Cranberry Upside-down Pudding	16
21	Banana Cream Pie**	4
22	Streusel Apple Pie	2
23	Key Lime Pie	8
24	Cherry Pie*	2
25	Raisin Pie*	16
26	Peach Pie*	4
27	Dutch Apple Pie**	4
28	Lemon Cake Pie	8
29	Chiffon Pie*	16
30	Cream Puffs, Ice Cream Filling and Chocolate Sauce**	4
31	Cream Puffs with Cream Filling	4
32	Sherbert	2
33	Sherbert with Topping or Fruit Sauce	2
34	Sherbert and Cookie	2
35	Ice Cream Cake Roll	4
36	Neopolitan Ice Cream Slice	4
37	Ice Box Dessert**	8
38	Frozen Lime Dream	16
39	Cheese Cake with Rasberry Sauce	8
40	Peppermint Ice Cream and Chocolate Sauce	8
41	Cherry Sundae	4
42	Poire Belle Helene	16
43	Frozen Lime Crunch	8
44	Meringues with Chocolate Ice Cream and Chocolate Sauce	8
45	Ice Cream and Sherbert Parfait	4
46	Date Torte	8
47	English Toffee Pudding*	8
48	Banana Pudding	8
49	Angel Delight Pudding	8
50	Cherry Tarts*	4
51	Rhubarb Crisp	8
52	Peach Shortcake**	8
53	Peach Cobbler*	4
54	Strawberry Shortcake**	4
55	Apple Cobbler*	4
56	Cherry Cobbler**	4
57	Apricot Cobbler**	4
58	Blueberry Cobbler*	4
59	Blueberry Crisp	4
60	Canned Pineapple	8
61	Frozen Cherries*	8
62	Applesauce**	2
63	Cherries and Topping with Cookie	4
64	Peach Slices*	4
65	Pear Halves	2
66	Blue Plums*	8
67	Banana Slices	4
68	Grapefruit Halves	8
69	Apricot Halves	8
70	Strawberries and Cookie*	2
71	Fresh Fruit Cup and Cookie*	4
72	Fruit Cup with Sherbert	4

	Lunch entree items	FR
1	Hot Roast Beef Sandwich*	2
2	Bacon, Lettuce, Tomato Sandwich*	4
3	Reuben Sandwich**	8
4	Corned Beef Sandwich*	8
5	Spiced Lunch Meat Sandwich	8
6	Ham Salad Sandwich*	8
7	Salmon Salad Sandwich**	16
8	Grilled Cheese Sandwich*	2
9	Poor Boy Sandwich	8
10	Salami Sandwich	8
11	Egg Salad Sandwich**	16
12	Meat Salad Sandwich	16
13	Turkey Salad Sandwich	8
14	Hot Tuna Bun Sandwich**	4
15	Weiners in Bun**	2
16	Hamburgers*	2
17	Bolognaburger	16
18	College Joe	4
19	Pork Tenderloin on Bun	4
20	Beef, Tomato, Cheese on Bun	8
21	Friday Burger	8
22	Deep Sea Dandy in Bun	4
23	Deutsch Cheeseburger	16
24	Jumbo Pizza Sandwich	8
25	Pizza Burger	4
26	Pizza*	4
27	Chicken Cutlet on Bun*	8
28	Chicken Cutlet	4
29	Chicken Giblets on Rice	16
30	Chicken Salad on Roll*	8
31	Creamed Chicken on Biscuit*	8
32	Chicken a la King on Pancake**	0
33	Mock Chicken Leg**	16
34	Turkey Tetrazinni	8
35	Creamed Turkey on Potato**	16
36	Turkey a la King	8
37	Turkey Salad	8
38	Beef Chow Mein on Rice	8
39	Beef and Pork Casserole*	8
40	Baked Beef Hash*	8
41	Chipped Beef with Macaroni or Mashed Potato**	8
42	Chili*	4
43	Spaghetti and Meat Sauce*	4
44	Beef Pot Pie*	8
45	Beef Biscuit Roll**	8
46	Creole Spaghetti*	4
47	Beef Andalouse on Rice	16
48	Beef, Tomato and Macaroni	8
49	Meat Pinwheels	8
50	Cabbage Rolls	16
51	Stuffed Green Peppers*	16
52	Corned Beef and Cabbage**	16
53	Ham, Egg, and Noodles au Gratin	16
54	Grilled Ham and Pineapple	8
55	Fish and Potato Chip Casserole**	8
56	Whiting	8
57	Creamed Tuna on Biscuit**	8
58	Cheese Souffle*	16
59	Macaroni and Cheese*	8
60	Buttered Apple and Sausage*	16
61	Cherry Pancakes with Canadian Bacon	16
62	Corn Fritters and Canadian Bacon	16
63	Canadian Bacon, Cheese Sauce, and Tomatoes	16
64	Cold Plate (Bologna and Cheese)	8
65	Vegetable Plate	16
66	Frozen Fruit Salad and a Bread	16
67	Meat Salad, Soup and Roll	8

Table 5. (cont.)

	Lunch entree items (cont.)	FR
68	Tuna Fish Salad*	8
69	Egg and Bean Salad	16
70	Salad Bowl	4
71	K. State Salad Bowl	0
72	Tomato with Potato Salad*	16
73	Tomato with Egg Salad	16
74	Fruit Plate	16
	Lunch desserts	
1	Baked Custard*	8
2	Bread Pudding**	8
3	Tapioca Cream*	16
4	Rice Pudding**	16
5	Fruited Rice	16
6	Tapioca Pudding**	8
7	Junket Cream	8
8	Sherbert*	2
9	Popcicle	2
10	Ice Cream*	2
11	Ice Cream Slice	2
12	Fudgecicle	2
13	Ice Cream Sandwich	2
14	Coffee Ice Cream Slice	16
15	Chocolate Sundae	2
16	Pistachio Ice Cream with Chocolate Sauce	16
17	Ice Cream and Assorted Sauces	8
18	Chocolate Chip Cookie*	8
19	Rice Krispy Cookie**	8
20	Oatmeal Cookie	4
21	Sugar Cookie*	4
22	Cherry Crisp Square	8
23	Crisp Ginger Cookie**	8
24	Chocolate Chow Mein Cookie	16
25	Chocolate Nut Cookie	4
26	Karet Cookie	8
27	Peanut Butter Cookie*	2
28	Sour Cream Cookie	4
29	Almond Cookie	8
30	Oatmeal Fruit Bar*	4
31	Dutch Cookie	8
32	Butterscotch Chip Cookie	4
33	Chocolate Banana Square	16
34	Brownie**	2
35	Soft Gingerbread with Topping*	4
36	Polish Kolachi**	8
37	Date Torte	16

	Lunch desserts (cont.)	FR
38	Russian Cream with Raspberry Sauce	8
39	Butterscotch Pudding with Nuts	4
40	Banana Cream Pudding*	4
41	Lemon Snow**	8
42	Polka Dot Pudding	8
43	Grapenut Pudding*	8
44	Vanilla Pudding**	8
45	Strawberry Bavarian Cream*	4
46	Apricot Whip*	8
47	Marshmallow Pudding	8
48	Nut Brown Pudding	4
49	Chocolate Pudding	4
50	Lemon Cake Pudding*	4
51	Fudge Pudding*	4
52	Coconut Cream Pudding**	8
53	Peanut Butter Chiffon Pudding	4
54	Spice Cake with Pumpkin Icing**	4
55	Gelatin and Marshmallow Parfait	8
56	Gelatin Cubes with Topping	4
57	Tropical Lemon Mold with Topping	16
58	Whipped Gelatin	4
59	Orange-Prune Kuchen	8
60	Heavenly Hash	8
61	Canned Blue Plums*	16
62	Grapefruit Half	16
63	Pineapple and Orange Tidbits	8
64	Stewed Rhubarb*	8
65	Pineapple Chunks	4
66	Baked Apple*	4
67	Sliced Strawberries	4
68	Applesauce*	4
69	Apricot Halves	8
70	Banana in Orange Juice*	4
71	Pear with Meringue	8
72	Cherries*	4
73	Boysenberries	8
	Lunch salad items	
1	Tossed*	2
2	Lettuce Cubes	2
3	Shredded Lettuce*	2
4	Lettuce Wedge*	2

	Lunch Salad items (cont.)	FR
5	Raw Spinach	8
6	Chinese Salad	8
7	Bacon Slaw	8
8	Cabbage with Dressing	8
9	Cabbage-Raisin	8
10	Raw Cauliflower	8
11	German Cucumber	16
12	Cucumber in Sour Cream*	16
13	Cucumber Mold	16
14	Tomato-Cucumber*	4
15	Sliced Tomato*	2
16	Tomato, Celery, Onion	4
17	Carrot and Celery Sticks	8
18	Carrot-Raisin	8
19	Stuffed Celery	4
20	Pea, Celery, Cheese**	16
21	Garden Salad	2
22	Egg Slice and Asparagus*	16
23	Pickled Beet*	16
24	Cooked Vegetable Salad	16
25	Red Kidney Bean Salad	16
26	Cottage Cheese on Lettuce*	4
27	Macaroni Salad*	8
28	Devilled Egg**	4
29	Pickled Egg Slices	16
30	Blue Plum and Apricot	4
31	Blue Plum with Grapefruit	4
32	Blue Plum with Peach	8
33	Orange Slices	4
34	Grapefruit and Cranberry	4
35	Citrus Pinwheel	4
36	Spiced Pear*	2
37	Pear with Stuffing**	8
38	Pear and Apple	2
39	Pear and Cranberry	8
40	Pear and Cheese**	4
41	Pineapple and Cranberry	4
42	Pineapple and Date**	8
43	Pineapple with Jelly	4
44	Pineapple and Melon*	8
45	Pineapple with Strawberry Topping	4
46	Pineapple and Green Pepper	8
47	Applesauce*	2
48	Apple and Cheese	16
49	Peach with Prune	4
50	Peach with Date	4
51	Peach Half with Marshmallow	4
52	Banana and Orange*	4
53	Cantaloupe and Blue Plum	8

Table 5. (cont.)

	Lunch salad items (cont.)	FR
54	Melon Cubes**	4
55	Cantaloupe and Watermelon	2
56	Apricot and Apple	4
57	Apricots with Blushed Mayonnaise	4
58	Apricot with Grapefruit Section	8
59	Apricot and Banana*	4
60	Ambrosia	4
61	Mixed (canned) fruit	4
62	Stuffed Prune	8
63	Raw Cranberry	4
64	Overnight Fruit	4
65	Orange Slice with Gelatin Cube	
66	Jellied Apricots and Cherries*	4
67	Perfection Salad**	16
68	Fruit Juice Gelatin*	4
69	Rhubarb Mold*	4
70	Lime Gelatin and Pear*	4
71	Jellied Cherry Salad**	4
72	Blue Plum Mold*	8
73	Lemon Cheese	16
74	Peach and Watermelon	4
	Dinner salad items	
1	Tossed*	2
2	Lettuce Wedge*	2
3	Cabbage Slaw**	4
4	Cabbage Salad*	8
5	Cabbage-Raisin	8
6	Cabbage-Carrot*	16
7	Chinese Salad	8
8	Relishes*	4
9	Celery and Beet*	16
10	Stuffed Celery	4
11	Tomato, Celery, Onion	8
12	Cucumber and Radish	16
13	Cucumber with Watercress**	16
14	German Cucumber	16
15	Cucumber in Sour Cream*	16
16	Cucumber Mold	16
17	Raw Cauliflower	8
18	Pickled Beet*	16
19	Beets, Onion and Spinach*	16
20	Pea, Celery and Cheese**	16
21	Sweet Onion Rings in Sour Cream	16

	Dinner salad items (cont.)	FR
22	Belgian Endive and Dressing	16
23	Cooked Vegetable Salad	2
24	Egg, Celery, and Olive	16
25	Egg and radish	16
26	Egg Slice and Asparagus*	16
27	Cottage Cheese on Lettuce*	4
28	Macaroni Salad*	8
29	Red Kidney Bean Salad	16
30	Peach Half with Cole Slaw	8
31	Peach Slice with Cherry	4
32	Peach Half with Marshmallow	4
33	Persimmons with Grapefruit Segments	16
34	Apricots with Grapefruit Sections	8
35	Citrus Sections	2
36	Citrus Pinwheel	4
37	Ambrosia	4
38	Pineapple with Lime Gelatin	8
39	Pineapple, Marshmallow, Grape*	4
40	Pineapple Twist	4
41	Pineapple and Pepper	8
42	Banana, Apricot and Prune	4
43	Banana, Orange and Apple	2
44	Banana and Orange*	4
45	Apricot and Banana*	4
46	Apricot and Coconut	4
47	Apricots with Blushed Mayonnaise	4
48	Pear with Cranberry	8
49	Pear with Mandarin	4
50	Pear Half with Gelatin Cubes	4
51	Pear and Cheese	2
52	Apple and Cheese	16
53	Blushed Apple Sauce	4
54	Blue Plum with Apple	8
55	Blue Plum with Peach	8
56	Raw Cranberry	4
57	Cider and Cranberry	8
58	Fruited Cider	4
59	Waldorf Salad*	4
60	Grape Waldorf*	4
61	Winter Fruit Salad	4
62	Mixed (canned) fruit	4
63	Overnight fruit salad	4

	Dinner salad items (cont.)	FR
64	Goodie Salad	4
65	Shimmering Salad	8
66	Peach Gingerale Mold	4
67	Strawberry and Banana Mold	4
68	Fruit Gelatin	4
69	Applesauce Mold*	4
70	Lime Gelatin with Citrus**	4
71	Blueberry Mold	4
72	Strawberry Pineapple Gelatin*	4
73	Ribbon Mold*	4
74	Raspberry Mold**	4
75	Golden Glow	4
76	Perfection Salad**	16
77	Fruit Juice Gelatin*	4
78	Rhubarb Mold*	4
79	Lime Gelatin and Pear*	4
80	Jellied Cherry Salad**	4
81	Italian Salad	8
82	Melon Cubes**	4
	Salad items that appeared on both lunch and dinner menus	
1	Tossed salad*	2
2	Raw Cauliflower	8
3	Cabbage Salad*	8
4	Cabbage-Raisin	8
5	Lettuce Wedge*	2
6	Chinese salad	8
7	Egg slice and Asparagus*	16
8	Cottage Cheese on Lettuce*	4
9	Red Kidney Bean Salad	16
10	German Cucumber	16
11	Cucumber in Sour Cream*	16
12	Cucumber Mold	16
13	Stuffed Celery	4
14	Pickled Beet*	16
15	Cooked Vegetable Salad	16
16	Macaroni*	8
17	Pea, Celery and Cheese**	16
18	Melon Cubes**	4
19	Apricots and Blushed Mayonnaise	4
20	Citrus Pinwheel	4
21	Apricot with Grapefruit Segment	8
22	Pineapple and Pepper	8
23	Ambrosia	4

Table 5. (concl.)

	Salad items that appeared on both lunch and dinner menus (cont.)	FR
24	Banana and Orange*	4
25	Apricot and Banana*	4
26	Apple and Cheese	16
27	Mixed (canned) Fruit	4
28	Overnight Fruit Salad	4
29	Pear and Cheese	2
30	Raw Cranberry	4
31	Peach Half with Marshmallow	4
32	Blue Plum with Peach	8
33	Perfection Salad**	16
34	Fruit Juice Gelatin*	4
35	Rhubarb Mold*	4
36	Lime Gelatin and Pear*	4
37	Jellied Cherry Salad**	4

Table 6. Menus planned by computer.

Menu	Characteristic T	F	C	S	PM[a]	Cost
Creole Spaghetti	4	2	2	6	3	.09
Cucumber in Sour Cream	4	6	1	7	6	.05
Spice Cake	1	2	2	5	7	.03
						.17
Pork Cutlet	3	3	2	1	3	.28
Scalloped Potato	4	4	1	7	3	.04
Whole Kernel Corn	6	6	3	4	1	.05
Pineapple, Marshmallow, Grape Salad	6	5	3	4	6	.08
Strawberries and Cookie	2	5	5	1	7	.10
						.55
Stuffed Green Pepper	3	2	4	1	3	.12
Tomato and Cucumber	2	6	3	7	6	.04
Tapioca Cream	1	5	1	6	7	.03
						.19
Pork Chops	6	3	2	1	3	.22
Rissole Potato	3	4	2	1	2	.02
Lima Beans	6	6	4	4	1	.05
Apple Sauce	5	5	1	6	7	.03
White Cake - Green Icing	1	5	1	5	7	.02
						.34
Tuna Fish Salad	1	3	1	1	7	.12
Tossed Salad	2	6	6	4	6	.04
Banana Cream Pudding	5	5	3	5	7	.05
						.21
Beef Pot Pie	4	3	2	4	1	.29
Parsley Buttered Potato	3	4	1	1	1	.02
Asparagus	3	6	4	3	1	.14
Relishes	2	6	6	3	6	.03
Peach Cobbler	3	5	3	2	3	.05
						.53
Buttered Apple and Sausage	3	3	2	2	3	.17
Cabbage-Carrot Salad	2	6	4	3	6	.02
Strawberry Bavarian	5	5	5	2	7	.08
						.27
Barbequed Spareribs	6	2	2	3	3	.29
Parsley Buttered Potato	3	4	1	1	1	.02
Wax Beans	6	6	3	3	1	.05
Rhubarb Mold	1	5	5	2	7	.03
Spice Cake	1	2	2	5	7	.03
						.42

Table 6. (cont.)

Menu	Characteristic T	F	C	S	PM[a]	Cost
Chili and Crackers	4	2	5	4	1	.10
Sliced Tomato on Lettuce	3	6	3	7	6	.04
Ice Cream	5	5	1	1	6	.06
						.20
Barbequed Veal Chops	6	2	2	1	3	.36
Creamed Potato	4	4	1	1	1	.03
Wilted Spinach	3	6	4	4	1	.06
Cucumber in Sour Cream	4	6	1	7	6	.05
Cherry Pie	6	5	5	5	7	.08
						.58
Baked Beef Hash	1	3	2	1	3	.10
Beets, Onion on Spinach	2	2	5	4	7	.07
Custard	1	5	3	1	3	.04
						.21
Chicken Cutlet	3	3	2	1	2	.19
Rice	3	4	1	4	1	.02
Buttered Green Beans	6	6	4	3	1	.06
Relishes	2	6	6	3	6	.03
Apple Cobbler	3	5	2	2	3	.05
						.35
Ham Salad Sandwich	1	3	5	2	7	.10
Rhubarb Mold	1	5	5	2	7	.03
Gingerbread with Topping	3	2	2	2	3	.03
						.16
Barbequed Chicken	3	2	2	1	3	.29
Parsley Buttered Potato	3	4	1	1	1	.02
Squash	5	4	3	1	3	.04
Cabbage Salad	2	6	4	3	6	.02
Chiffon Pie	5	2	3	5	7	.03
						.40
Hot Roast Beef Sandwich	3	3	2	2	4	.14
Macaroni Salad	4	4	1	1	7	.08
Banana in Orange Juice	4	5	3	7	6	.05
						.27
Baked Ham	3	3	5	7	3	.32
Mashed Potato	5	4	1	1	1	.02
Asparagus	3	6	4	3	1	.14
Cucumber in Sour Cream	4	6	1	7	6	.05
Frozen Cherries	6	5	5	1	6	.04
						.57

Table 6. (cont.)

Menu	Characteristic T	F	C	S	PM[a]	Cost
Cheese Souffle	5	3	3	2	3	.06
Celery and Beet	2	6	5	1	6	.06
Baked Apple	5	4	2	1	3	.07
						.19
Roast Beef	3	3	2	7	4	.32
Creamed Potato	4	4	1	1	1	.03
Harvard Beet	4	2	5	3	1	.08
Applesauce Mold	1	5	4	2	7	.04
Frosted Brownie	3	5	2	2	7	.06
						.53
Creamed Chicken on Biscuit	4	4	1	6	1	.17
Rhubarb Mold	1	5	5	2	7	.03
Sugar Cookie	2	5	1	7	7	.02
						.22
Veal Fricassee	4	3	2	4	1	.21
Rice	3	4	1	4	1	.02
Broiled Tomato	1	6	5	1	5	.06
Cabbage-Carrot Salad	2	6	4	3	6	.02
Cherry Tarts	6	5	5	5	7	.12
						.43
Chicken Salad and Roll	3	3	1	1	7	.15
Tomato and Cucumber	2	6	3	7	6	.04
Banana and Orange Juice	4	5	3	7	6	.05
						.24
Pot Roast of Beef	1	3	2	7	4	.32
Jacket Potato	1	4	2	1	1	.02
Buttered Apple	1	5	1	3	3	.05
Waldorf Salad	2	6	1	4	7	.06
Strawberries and Cookie	2	5	5	1	7	.10
						.55
Hamburger on Bun	6	3	2	1	5	.15
Beets, Onion on Spinach	2	2	5	4	7	.07
Grapenut Pudding	1	5	2	6	7	.05
						.27
Catfish and Lemon	1	3	1	1	3	.18
Mashed Potato	5	4	1	1	1	.02
Carrot Rings	6	5	3	7	1	.02
Sliced Tomato on Lettuce	3	6	3	7	6	.04
Frosted Brownie	3	5	2	2	7	.06
						.32

Table 6. (cont.)

Menu	Characteristic T	F	C	S	PM[a]	Cost
Macaroni and Cheese	4	3	3	6	3	.06
Shredded Lettuce	2	4	4	3	6	.02
Banana in Orange Juice	4	5	3	7	6	.05
						.13
Oven-Fried Chicken	6	3	2	1	2	.36
Creamed Potato	4	4	1	1	1	.03
Candied Julienne Carrots	3	5	3	3	1	.03
Beets, Onion, and Spinach	2	2	5	4	7	.07
Cherry Tarts	6	5	5	5	7	.12
						.61
Spaghetti and Meat Sauce	4	2	5	4	1	.13
Egg Slice and Asparagus	3	6	6	3	7	.16
Custard	1	5	3	1	3	.04
						.33
Swedish Meat Balls	4	3	2	1	3	.12
Oven Brown Potato	3	4	2	1	3	.02
Carrot Sticks	6	5	3	3	1	.02
Sliced Tomato on Lettuce	3	6	3	7	6	.04
Marble Cake	1	5	6	5	7	.02
						.22
Corned Beef Sandwich	3	2	5	2	7	.13
Tomato and Cucumber	2	6	3	7	6	.04
Oatmeal Fruit Bar	6	5	2	2	7	.02
						.19
Ham Loaf	1	3	5	2	3	.16
Mashed Potato	5	4	1	1	1	.02
Peas	3	5	4	4	1	.05
Tossed Salad	2	6	6	4	6	.04
Chocolate Cake - Fluffy Icing	1	5	2	5	7	.03
						.30
Bacon, Lettuce, Tomato Sandwich	2	6	6	2	7	.14
Lime Gelatin and Pear	1	5	4	2	7	.05
Fudge Pudding	4	5	2	2	3	.05
						.24
Baked Sole in Tomato Sauce	4	3	5	3	3	.16
Franconia Potato	3	4	2	1	4	.02
Squash	5	4	3	1	3	.04
Relishes	2	6	6	3	6	.03
Lady Baltimore Cake	1	5	1	5	7	.05
						.30

Table 6. (cont.)

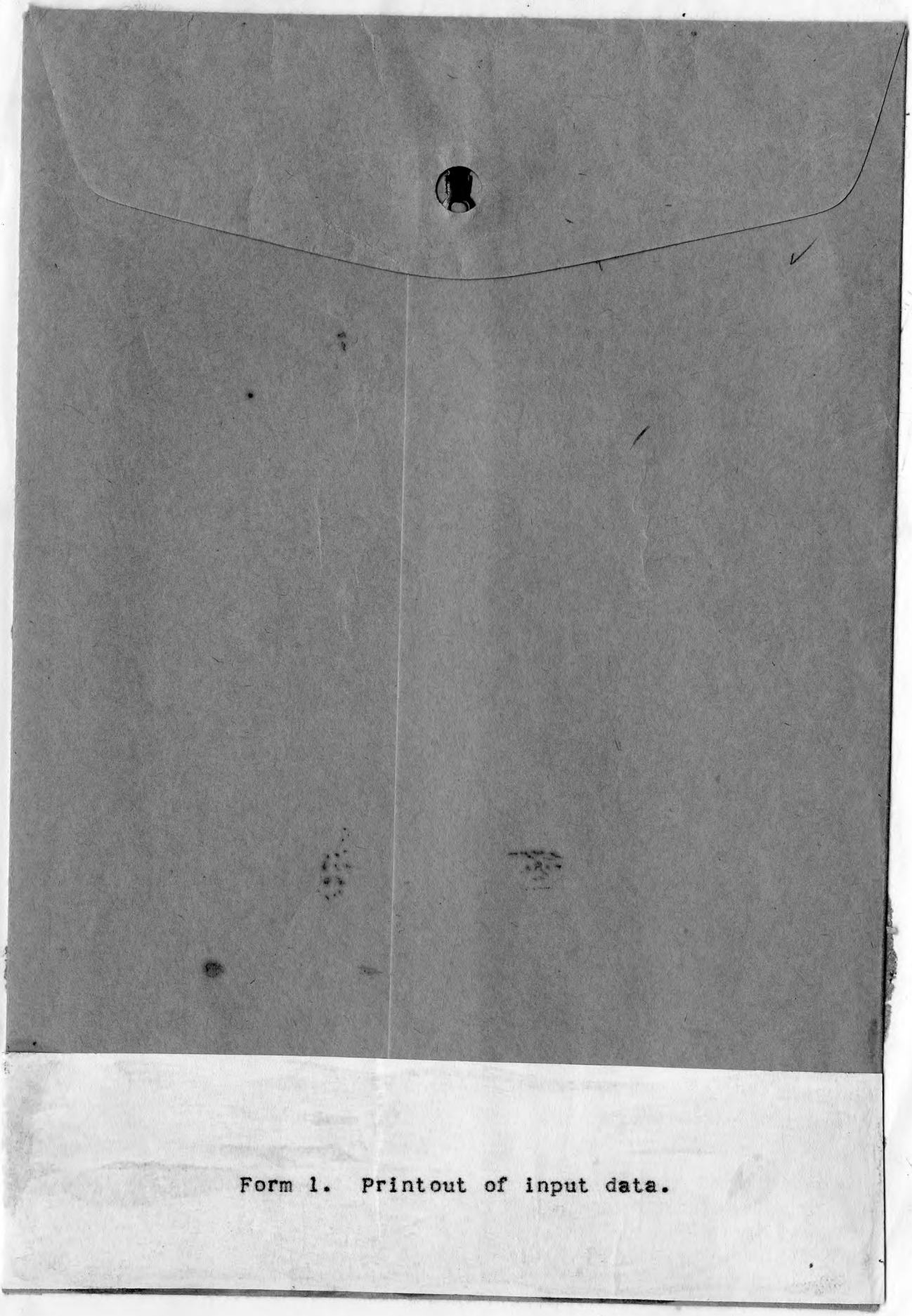
Menu	Characteristic T	F	C	S	PM[a]	Cost
Pizza	2	2	5	5	3	.10
Tomato and Cucumber	2	6	3	7	6	.04
Apricot Whip	5	5	3	1	7	.02
						.16
Swiss Steak	4	3	2	2	3	.28
Parsley Buttered Potato	3	4	1	1	1	.02
Asparagus	3	6	4	3	1	.14
Pickled Beet	3	2	5	1	7	.07
Angelfood and Strawberries	5	5	5	5	7	.02
						.53
Corn Fritters and Canadian Bacon	2	3	5	1	2	.16
Cucumber in Sour Cream	4	6	1	7	6	.05
Strawberry Bavarian	5	5	5	2	7	.08
						.29
Meat Loaf	1	3	2	2	3	.12
Sweet Potato	1	5	3	1	1	.04
Wilted Spinach	3	6	4	4	1	.06
Cabbage-Carrot Salad	2	6	4	3	6	.02
Grapefruit Half	6	1	3	1	6	.10
						.34
Beef Pot Pie	6	3	2	4	3	.29
Tomato and Cucumber	2	6	3	7	6	.04
Stewed Rhubarb	3	5	5	4	7	.03
						.36
Liver and Onions	3	2	2	1	3	.13
Creamed Potato	4	4	1	1	1	.03
Carrot Sticks	6	5	3	3	1	.02
Beets, Onion and Spinach	2	2	5	4	7	.07
Cherry Tarts	6	5	5	5	7	.12
						.37
Grilled Cheese Sandwich	2	3	2	2	5	.05
Egg Slice and Asparagus	3	6	6	3	7	.16
Chocolate Chip Cookie	2	5	2	7	7	.03
						.24
Roast Turkey	3	4	1	7	4	.29
Franconia Potato	3	4	2	1	4	.02
Lima Beans	6	6	4	4	1	.05
Macaroni Salad	4	4	1	1	7	.08
Chiffon Pie	5	2	3	5	7	.03
						.47

Table 6. (concl.)

Menu	Characteristic T	F	C	S	PM[a]	Cost
Beef and Pork Casserole	4	3	2	4	3	.13
Applesauce Mold	1	5	4	2	7	.04
Lemon Cake Pudding	4	2	3	2	3	.04
						.21
Smothered Steak	4	3	2	1	3	.28
Parsley Buttered Potato	3	4	1	1	1	.02
Candied Julienne Carrots	3	5	3	3	1	.03
Rhubarb Mold	1	5	5	2	7	.03
Grapefruit Half	6	1	3	1	6	.10
						.46

[a] T texture
F flavor
C color
S shape
PM preparation method

APPENDIX B



Form 1. Printout of input data.

PRINTOUT OF INPUT DATA FOR COMPUTER PLANNED MENUS

MENU ITEM NAME	CODES*
DINNER ENTREE LIST	MENU CLASS 1
CATFISH AND LEMON	181 13113 4
CHICKEN CUTLET	191 33212 8
MEAT LOAF	121 13223 4
POT ROAST OF BEEF	321 13274 4
HAM LOAF	161 13523 4
LIVER AND ONIONS	131 32213 8
BARBEQUED CHICKEN	291 32213 4
PORK CUTLET	281 33213 4
ROAST BEEF	321 33274 2
BAKED HAM	321 33573 4
ROAST TURKEY	291 34174 4
SMOTHERED STEAK	281 43213 4
SWEDISH MEAT BALLS	121 43213 8
SWISS STEAK	281 43223 4
VEAL FRICASSEE	211 43241 4
BEEF POT PIE	291 43241 8
BAKED SOLE IN TOMATO SAUCE	161 4353316
BARBEQUED VEAL CHOPS	361 62213 8
BARBEQUED SPARERIBS	291 62233 8
OVEN-FRIED CHICKEN	361 63212 4
PORK CHOPS	221 63213 4
POTATO LIST	MENU CLASS 7
JACKET POTATO	027 14211 2
FRANCONIA POTATO	027 34214 2
SWEET POTATO	047 15311 4
FRENCH FRIED POTATO	087 24232 2
PARSLEY BUTTERED POTATO	027 34111 2
RICE	027 34141 4
RISSOLE POTATO	027 34212 2
OVEN BROWN POTATO	027 34213 2
HASH BROWN POTATO	027 34272 4
POTATO AU GRATIN	077 43343 4
CREAMED POTATO	037 44111 2
SCALLOPED POTATO	047 44173 4
MASHED POTATO	027 54111 2
VEGETABLE LIST	MENU CLASS 2
BABY BOILED ONIONS	082 1211116
BUTTERED APPLE	052 15133 8
BROILED TOMATO	062 16515 8
FRENCH FRIED ONIONS	032 22212 4
CANDIED JULIENNE CARROTS	032 35331 4
PEAS	052 35441 2
BROCOLLI	072 36431 4
ASPARAGUS	142 36431 4
PEAS AND ONIONS	062 3644116
WILTED SPINACH	062 36441 8
HARVARD BEET	082 42531 4

SCALLOPED CORN	042 46343 8
SQUASH	042 54313 8
BRUSSEL SPROUTS	092 62411 4
CARROT STICKS	022 65331 4
CARROT RINGS	022 65371 4
WAX BEANS	052 66331 4
WHOLE KERNEL CORN	052 66341 2
BUTTERED GREEN BEANS	062 66431 2
LIMA BEANS	052 66441 8
MIXED VEGETABLES	052 66641 2

SALAD LIST MENU CLASS 3

SPICED PEAR	073 12516 2
COTTAGE CHEESE ON LETTUCE	053 14116 4
RIBBON MOLD	033 14527 4
FRUIT JUICE GELATIN	013 15327 4
APPLESAUCE MOLD	043 15427 4
LIME GELATIN AND PEAR	053 15427 4
STRAWBERRY-PINEAPPLE GELATIN	053 15526 4
RHUBARB MOLD	033 15527 4
JELLIED APRICOTS AND CHERRIES	043 15527 4
BLUE PLUM MOLD	043 15727 8
BEETS,ONION-SPINACH	073 2254716
TOMATO AND CUCUMBER	043 26376 4
SHREDDED LETTUCE	023 24436 2
WALDORF SALAD	063 26147 4
CABBAGE-CARROT SALAD	023 2643616
CABBAGE SALAD	023 26436 8
LETTUCE WEDGE	023 26456 2
CELERY AND BEET	063 2651616
RELISHES	033 26636 4
TOSSED SALAD	043 26646 2
PICKLED BEET	073 3251716
GRAPE WALDORF	063 35116 4
APRICOT AND BANANA	073 35316 4
BANANA AND ORANGE	073 35316 4
SLICED TOMATO ON LETTUCE	043 36376 2
EGG SLICE AND ASPARAGUS	163 3663716
MACARONI SALAD	083 44117 8
CUCUMBER IN SOUR CREAM	053 4617616
APPLE SAUCE	033 55167 2
PINEAPPLE AND MELON	043 65316 8
PINEAP-MSH.MAL-GRAPE	083 65346 4

DINNER DESSERT LIST MENU CLASS 4

SPICE CAKE	034 12257 4
LADY BALTIMORE CAKE	054 15157 4
FROSTED BROWNIES	064 35227 2
ENGLISH TOFFEE PUDDING	084 15227 8
CHOCOLATE CAKE WITH FLUFFY ICI	034 15257 4
PEACH SLICES	044 15336 4

WHITE CAKE-GREEN ICING	024 1515716
MARBLE CAKE	024 15657 8
BLUE PLUMS	044 15716 8
STRAWBERRIES AND COOKIE	104 25517 2
FRESH FRUIT CUP AND COOKIE	104 25666 4
APPLE COBBLER	054 35223 4
RAISIN PIE	064 3525716
PEACH COBBLER	054 35323 4
BLUEBERRY COBBLER	094 35723 4

CHIFFON PIE	034 5235716	
ANGELFOOD AND STRAWBERRIES	024 55557 4	
GRAPEFRUIT HALF	104 61316 8	
FROZEN CHERRIES	044 65516 8	
CHERRY TARTS	124 65557 4	
CHERRY PIE	084 65557 2	

LUNCH ENTREE LIST MENU CLASS 5

TUNA FISH SALAD	125 13117 8	
BAKED BEEF HASH	105 13213 8	
HAM SALAD SANDWICH	105 13527 8	
PIZZA	105 22553 4	
GRILLED CHEESE SANDWICH	055 23225 2	
CORN FRITTERS AND CANADIAN BAC	165 2351216	
BACON,LETTUCE,TOMATO SANDWICH	145 26627 4	
STUFFED GREEN PEPPER	125 3241316	
CORNED BEEF SANDWICH	135 32527 8	
CHICKEN SALAD AND ROLL	155 33117 8	
HAMBURGER ON BUN	155 63215 2	
BUTTERED APPLE AND SAUSAGE	175 3322316	
HOT ROAST BEEF SANDWICH	145 33224 2	
CREOLE SPAGHETTI	095 42263 4	
CHILI AND CRACKERS	105 42541 4	
SPAGHETTI AND MEAT SAUCE	135 42541 4	
BEEF AND PORK CASSEROLE	135 43243 8	
MACARONI AND CHEESE	065 43363 8	
CREAMED CHICKEN ON BISCUIT	175 44161 8	
CHEESE SOUFLEE	065 5332316	
BEEF POT PIE	295 63243 8	

LUNCH DESSERT LIST MENU CLASS 6

GINGERBREAD WITH TOPPING	036 32223 4	
ICECREAM	066 55116 2	
TAPIOCA CREAM	036 15167 4	
GRAPENUT PUDDING	056 15267 8	
CUSTARD	046 15313 8	
SHERBET	046 55317 2	
CANNED BLUE PLUMS	046 1571716	
SUGAR COOKIE	026 25177 4	
CHOCOLATE CHIP COOKIE	036 25277 8	
PEANUT BUTTER COOKIE	026 25277 2	
STEWED RHUBARB	036 35547 8	
LEMON CAKE PUDDING	046 42323 4	
FUDGE PUDDING	056 45223 4	
BANANA IN ORANGE JUICE	056 45376 4	
BAKED APPLE	076 54213 4	
APPLE SAUCE	036 55167 4	
APRICOT WHIP	026 55317 8	
BANANA CREAM PUDDING	056 55357 4	
STRAWBERRY BAVARIAN	086 55527 4	
OATMEAL FRUIT BAR	026 65227 4	

CHERRIES	046 65516 4	

* COLS 31, 32 COST
COL 33 MENU ITEM CLASS
COLS 35 TO 39 PALATABILITY CODES
COLS 40, 41 FREQUENCY RATING

A Guide to Good Eating

Use Daily:

Milk Group

3 or more glasses milk — Children
smaller glasses for some children under 9

4 or more glasses — Teen-agers

2 or more glasses — Adults

Cheese, ice cream and other milk-made foods can supply part of the milk

Meat Group

2 or more servings

Meats, fish, poultry, eggs, or cheese—with dry beans, peas, nuts as alternates

Vegetables and Fruits

4 or more servings

Include dark green or yellow vegetables; citrus fruit or tomatoes

Breads and Cereals

4 or more servings

Enriched or whole grain
Added milk improves nutritional values

This is the foundation for a good diet. Use more of these and other foods as needed for growth, for activity, and for desirable weight.

A Guide to Good Eating helps you plan or choose pleasing and satisfying meals that provide good nutrition. It suggests minimum amounts of food from each of 4 food groups which should be included in each day's meals. This menu plan shows one way to include the 4 important food groups in a day's meals:

Breakfast	**Dinner**
Fruit	Main Protein Dish
Cereal or Egg or Both	Vegetable Potato
Toast or Roll and Butter	Bread or Roll and Butter
Milk Coffee	Milk Dessert

Lunch or Supper

Main Protein Dish Vegetable Bread and Butter
Milk Fruit

Vary your menus to suit your taste. In using the dairy foods for their important calcium . . .

1 glass milk = 8 ounces or ¼ quart
1 slice American cheese (1 oz.) = ¾ glass milk
½ cup creamed cottage cheese = ⅓ glass milk
½ cup (¼ pint) ice cream = ¼ glass milk

In the meat group, 2 servings should give at least as much protein as 4 ounces cooked lean meat (⅓ pound raw). About equal amounts of protein come from . . .

1 ounce cooked lean meat, poultry, or fish
1 egg
1 slice cheese, American or Swiss (1 ounce)
2 tablespoons creamed cottage cheese (1 ounce)
2 tablespoons peanut butter (1 ounce)
½ cup cooked dried beans or peas

An average serving of vegetables or fruits is ½ cup; of bread, 1 slice; of cereal, ½ to ¾ cup.

The nutritional statements made on this leaflet have been reviewed by the Council on Foods and Nutrition of the American Medical Association and found consistent with current authoritative medical opinion.

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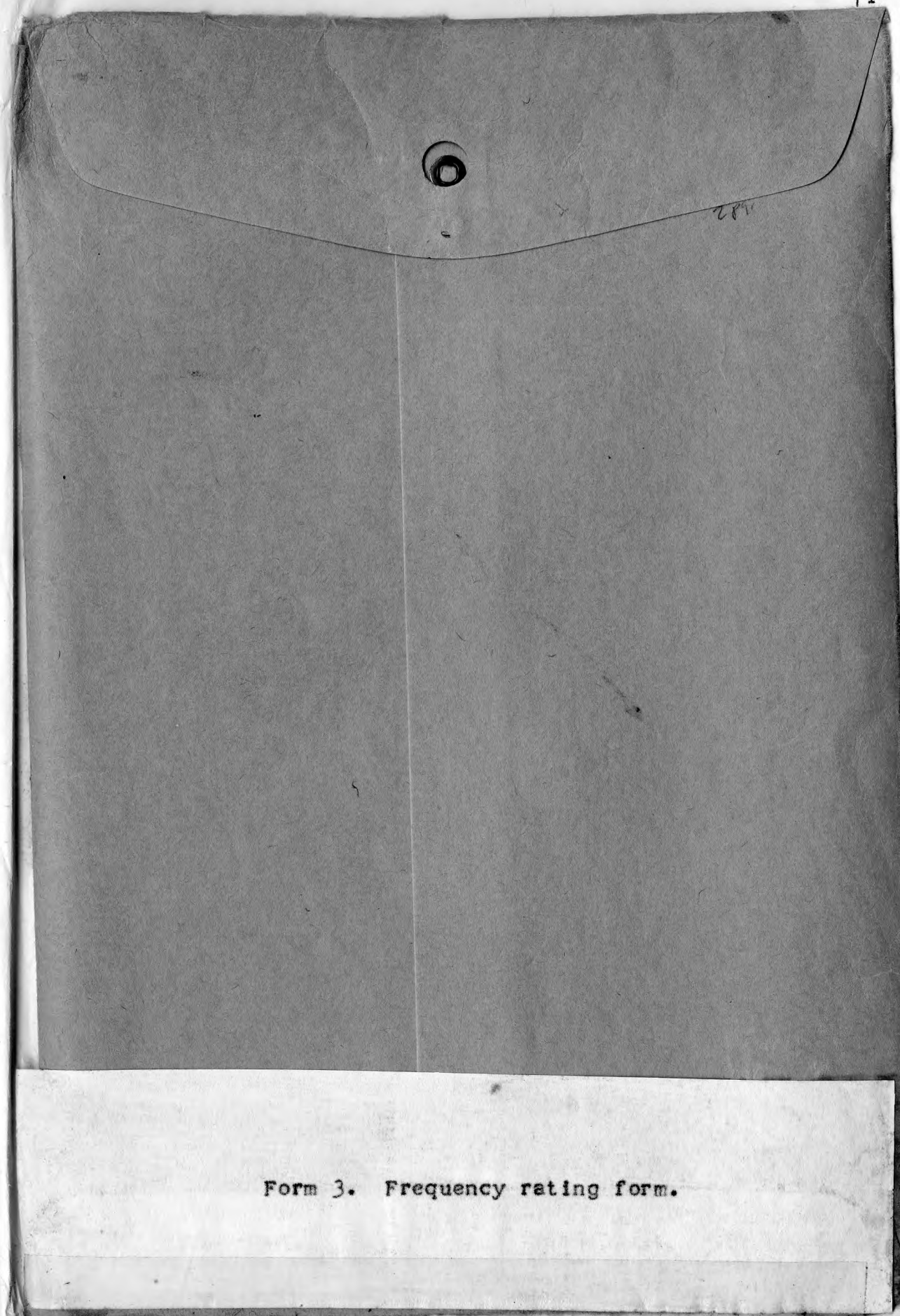
Form 2. Basic Four food groups.



Form 3. Frequency rating form.

In order to proceed with computer menu-planning, it is necessary to obtain information regarding frequency ratings of menu items.

The following items appeared on Residence Hall menus throughout spring semester 1965.

Evaluate the following menu items on a semester basis. A semester equals 16 weeks. Please check under one heading for each food, i.e. do you consider baked chicken sufficiently popular with students to be served 8 times a semester (once every 2 weeks) or 4 times a semester (once every 4 weeks) or 2 times a semester (once every 8 weeks) or once a semester, or is baked chicken so unpopular that it should never be served?

Certain menu items appeared in combination, e.g. pineapple chunks with sugar cookies. These were separated for purposes of this evaluation.

ENTREES - DINNER

	2 weeks (8x semesters)	4 weeks (2x semester)	8 weeks (4x semester)	16 weeks (8x semester)	Never
Roast Turkey					
Baked Chicken					
Barbecued Chicken					
Chicken Cutlet with sauce					
Cornflake Chicken					
Oven-fried Chicken					
Antoines Chicken Creole					
Chicken Giblets					
Oklahoma Chicken Loaf					
Baked Chicken leg & thigh					
Roast Beef					
Pot Roast of Beef					
T-bone Steak					
Chopped Round Steak					
Steak					
Minute Steak					
Meat Loaf					
Baked Flank Steak					
Brunswick Stew					
Smothered Steak					
Salisbury Steak					
Swiss Steak					
Roast Pork					
Pork Cutlet					
Danish Pork Chops					
Butterfly Pork Chops					
Ham with Cranberry sauce					
Ham Loaf					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Glazed Ham Patty					
Barbecued Spare Ribs					
Lamb Chops					
Lamb Chips					
Veal Cutlets with cheese sauce					
Barbecued Veal Chops					
Veal Fricassee					
Veal New Orleans					
Baked Sale in tomato sauce					
Shrimp Jambalaya					
Halibut Steak					
French Fried Grouper					
Catfish with lemon					
Fried Fish					
Fishermans Feast					
Swordfish					
Baked Haddock					
Beef Pot Pie					
Turnovers with gravy					
Pizza					
Porcupine Meat Balls					
Swedish Meat Balls					
Italian Spaghetti					
Liver with onions					
Smoked Knackwurst					
	LUNCH - ENTREE				
Weiners in bun					
Hot Roast Beef Sandwich					
Hamburgers					
Bacon, lettuce, tomato sandwich					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Bolognaburgers					
Reuben Sandwich					
Corned Beef Sandwich					
College Joe					
Pork Tenderloin on bun					
Spiced Lunch Meat Sandwich					
Ham Salad Sandwich					
Salmon Salad Sandwich					
Grilled Cheese Sandwich					
Beef, Tomato, cheese on bun					
Poor Boy Sandwich					
Friday Burger					
Salami Sandwich					
Deep Sea Dandy in Bun					
Hot Tuna Bun Sandwich					
Jumbo Pizza Sandwich					
Egg Salad Sandwich					
Meat Salad Sandwich					
Turkey Salad Sandwich					
Deutsch Cheeseburger					
Pizza					
Chicken Cutlet on bun					
Chicken Giblets on rice					
Beef Chow Mein on rice					
Pizza Burger					
Beef and Pork Casserole					
Corn Fritters and Canadian Bacon					
Macaroni and Cheese					
Chicken a la King and Pancakes					
Mock Chicken leg					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Baked Beef Hash					
Chipped Beef with Macaroni or mashed potato					
Chili					
Chicken Cutlet					
Cheese Soufflee					
Buttered Apple and Sausage					
Cabbage Rolls					
Fish and Potato Chip Casserole					
Turkey Titrazinni					
Beef Pot Pie					
Beef Biscuit Roll					
Creamed Chicken on Biscuit					
Whiting					
Beef Andalouse on rice					
Cherry Pancakes with Canadian Bacon					
Turkey a la King on Biscuit					
Ham, eggs, noodles au Gratin					
Creole spaghetti					
Canadian Bacon, cheese sauce with tomatoes					
Creamed Turkey on Potato					
Grilled Ham and Pineapple					
Beef, Tomato and Macaroni					
Creamed Tuna on Biscuit					
Meat Pinwheels					
Stuffed Green Peppers					
Corned Beef and Cabbage					
Chicken Salad and Roll					
Cold Plate (bologna and cheese)					
Vegetable Plate					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Turkey Salad					
Frozen Fruit Salad and a bread					
Meat salad, soup and roll					
Tuna Fish Salad					
Egg and Bean Salad					
Salad Bowl					
Tomato Stuffed with egg salad					
Tomato with Potato Salad					
Fruit Plate					
	POTATO				
Whipped (mashed)					
Rissole					
Cream					
French Fried					
Parsley Buttered					
O'Brein					
Oven Brown					
Scalloped					
Jacket					
Tater Tots					
Potato au Gratin					
Franciona					
Hash Browns					
Rice					
Green Rice					
Sweet Potatoes					
	VEGETABLE				
Buttered Green Beans					
Canned Beans					
Wax Beens					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Creamed Beans					
Lima Beans					
Lima Beans and Brocolli					
Succotash					
Whole Kernel Corn					
Scalloped Corn					
Brocolli					
Spinach with vinegar					
Wilted Spinach					
Peas					
Continental Peas					
Turnip, Peas and Cream					
Peas and Onions					
Boiled Baby Onions					
Creamed Onion					
French Fried Onions					
Sauerkraut					
Buttered Mixed Vegetables					
Harvard Beets					
Beets in Orange sauce					
Brussel Sprouts					
Celery					
Parsnips					
Carrots					
Candied Julienne Carrots					
Asparagus					
Scalloped Asparagus					
Rutabaga					
Hominy					
Zucchini					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Squash					
Sweet and Sour Red Cabbage					
Fr ench-fried Cauliflower					
Vegetable Timbale					
Grilled Peach					
Buttered Apple					
Broiled Tomato					
Stewed Tomato					
	SALADS				
Served at lunch only:					
Chinese					
Lettuce Cubes					
Shredded Lettuce					
Bacon Slaw					
Raw Spinach					
Garden Salad					
Tomato, Celery, Onion					
Carrot and Celery Sticks					
Peas, Celery and Cheese					
Sliced Tomato					
Tomato, Cucumber and Green Pepper					
Carrot-Raison					
Blue Plum and Apricot					
Orange Slices					
Blushing Pear (Spiced Pear)					
Pineapple and Cranberry					
Applesauce					
Pineapple and dates					
Pear and Apple					
Peach with Prune					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Blue Plum with Grapefruit					
Banana and Orange					
Pear and Cheese					
Pineapple with Jelly					
Blue Plum Mold					
Cantaloupe and Blue Plum					
Grapefruit and Cranberry					
Pineapple and Melon					
Cantaloupe and Watermelon					
Pineapple with Strawberry Topping					
Stuffed Prune					
Apricot and Apple					
Peach with Date					
Jellied Apricot and Cherries					
Pear and Cranberry					
Peach and Watermelon					
Orange Slice with Gelatin Cubes					
Lemon Cheese					
Devilled Egg					
Pickled Egg Slices					
Served only at dinner:					
Combination Vegetable					
Relishes					
Celery and Beet					
Cucumber and Radish					
Peach Half with Cole Slaw					
Tomato, Celery and Onion					
Beets, Onion and Spinach					
Cucumber with Water Cress					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Sweet Onion Rings in Sour Cream					
Cabbage, Carrot, Radish					
Belgian Endive and Dressing					
Egg, Celery and Olive					
Persommons with Grapefruit Segments					
Pineapple with Lime Gelatin Garnish					
Goodie Salad					
Banana, Apricot and Prune					
Apricot and Coconut					
Winter Fruit Salad					
Waldorf Salad					
Pear with Cranberry					
Pineapple and Grape					
Peach Slice with Cherry					
Blushed Applesauce					
Citrus Sections					
Banana, Orange and Apple					
Pear and Mandarin					
Blue Plum with Apple					
Pear Half with Gelatin Cubes					
Grape Waldorf					
Cider and Cranberry					
Pineapple Twist					
Fruited Cider					
Shimmering Salad					
Peach Gingerale Mold					
Strawberry and Banana Mold					
Fruit Juice Gelatin					
Jellied Applesauce					
Lime Gelatin with Citrus					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Blueberry Mold					
Strawberry Pineapple Gelatin					
Ribbon Mold					
Raspberry Mold					
Golden Glow					
Italian Salad					
Egg and Radish					
Salads served at both lunch and dinner					
Tossed					
Raw Cauliflower					
Cabbage with Dressing					
Cabbage-Raisin with Marshmallow					
Lettuce Wedge					
Cabbage Slaw					
Chinese					
Egg Slice and Asparagus					
Cottage Cheese					
Red Kidney Bean Salad					
German Cucumber					
Cucumber in Sour Cream					
Cucumber Mold					
Stuffed Celery					
Pickled Beet					
Cooked Vegetable Salad					
Macaroni					
Pea, Celery and Cheese					
Melon Cubes					
Apricots with Blushed mayonnaise					
Citrus Pinwheel					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Apricot with Grapefruit Sections					
Pineapple and Pepper					
Ambrosia					
Apricot and Banana					
Mixed (canned) Fruit					
Pear and Cheese					
Raw Cranberry					
Peach Half with Marshmallow					
Blue Plum with Peach					
Perfection Salad					
Fruit Juice Gelatin					
Rhubarb Mold					
Lime Gelatin and Pear					
Jellied Cherry Salad					
	DINNER DESSERTS				
Karet German Spice Cake					
Spice Cake with Coconut Pecan Frosting					
Spice Cake with Burnt Sugar Frosting					
Angel Food Cake with Chocolate Frosting					
Angel Food Cake with Strawberries and Topping					
Angel Food Cake and Lemon Sauce					
Chocolate Cake with Fluffy Icing					
German Chocolate Cake					
Pineapple Cashew Cake					
Cherry Glaze Cake					
Plantation Marble Cake					
Lady Baltimore Cake					
Lemon Coconut Cake					
Yellow Cake with Chocolate Icing					
White Cake with Green Icing					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Lemon Cake Pudding					
Brownies with Icing					
Pear Ginger Upside-down Pudding					
Apricot Upside Down Pudding					
Cranberry Upside Down Pudding					
Banana Cream Pie					
Streusel Apple Pie					
Key 'line Pie					
Cherry Pie					
Raisin Pie					
Reach Pie					
Dutch Apple Pie					
Lemon Cake Pie					
Cherry Chiffon Pie					
Strawberry Chiffon Pie					
Frozen Lime Dream					
Cream Puffs, Ice Cream Filling and Chocolate Sauce					
Cream Puffs with Cream Filling					
Sherbert					
Sherbert with Topping or Fruit sauce					
Sherbert and Cookies					
Ice Cream Cake Roll					
Neopolitan Ice Cream Slice with Topping					
Ice Box Dessert					
Cheese Cake and Raspberry Sauce					
Peppermint Ice Cream and Chocolate Sauce					
Cherry Sundae					
Frozen Lemon Crunch					
Meringues with Chocolate Ice cream with Chocolate sauce					

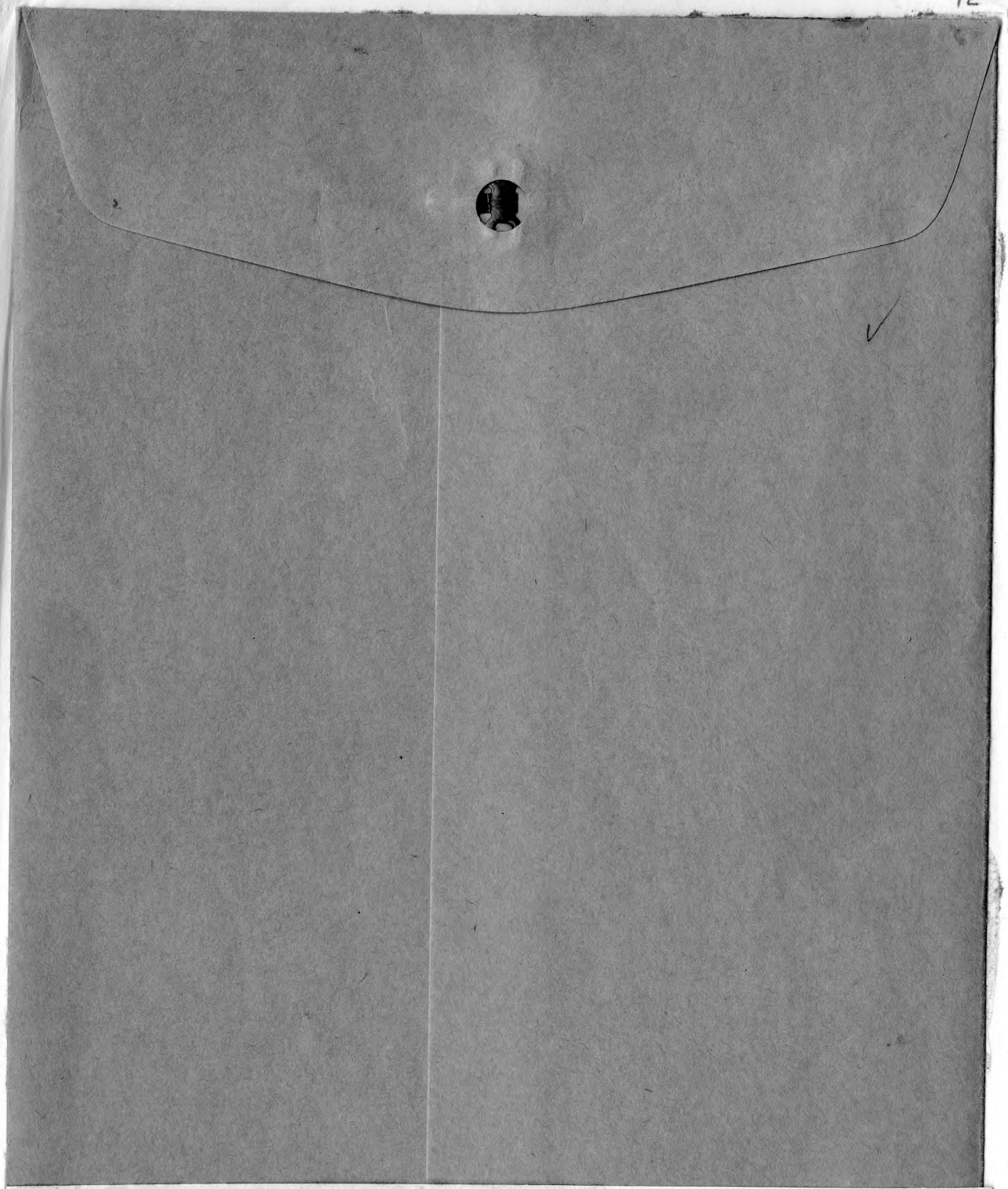
	2 weeks	4 weeks	8 weeks	16 weeks	Never
Ice Cream and Sherbert Parfait					
Date Torte					
English Toffee Pudding					
Banana Pudding					
Angel Delight Pudding					
Cherry Tarts					
Rhubarb Crisp					
Peach Shortcake					
Peach Cobbler					
Strawberry Shortcake					
Apple Cobbler					
Cherry Cobbler					
Apricot Cobbler					
Blueberry Cobbler					
Blueberry Crisp					
Canned Pineapple					
Frozen Cherries					
Applesauce					
Cherries and Topping with Cookie					
Peach Slices					
Pear Halves					
Poire Belle Helene					
Blue Plums					
Banana Slices					
Grapefruit Halves					
Apricot Halves					
Strawberries					
Fr esh Fruit Cup					
Fruit Cup with Sherbert					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
	LUNCH DESSERTS				
Custard					
Bread Pudding					
Tapioca Cream					
Rice Pudding					
Fruited Rice					
Tapioca Pudding					
Junket Cream					
Sherbert					
Popcicle					
Ice Cream Bar					
Ice Cream Slice					
Rudgecicle					
Ice Cream Sandwich					
Coffee Ice Cream Slice					
Chocolate Sundae					
Pistachio Ice Cream with Chocolate Sauce					
Ice Cream and Assorted Sauces					
Chocolate Chip Cookies					
Rice Krispy Cookies					
Oatmeal Cookies					
Sugar Cookie					
Cherry Crisp Square					
Crisp Ginger Cookies					
Chocolate Chow Mein Cookies					
Chocolate Nut Cookies					
Karet Cookies					
Peanut Butter Cookies					
Sour Cream Cookies					
Almond Cookies					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Oatmeal Fruit Bar					
Dutch Cookies					
Butterscotch Chip Cookies					
Chocolate Banana Square					
Brownie					
Soft Gingerbread with Topping					
Polish Kolachi					
Date Torte					
Russian Cream with Raspberry Sauce					
Butterscotch Pudding with Nuts					
Banana Cream Pudding					
Lemon Snow					
Polka Dot Pudding					
Grapenut Pudding					
Vanilla Pudding					
Strawberry Bavarian Cream					
Apricot Whip					
Marshmallow Pudding					
Nut Brown Pudding					
Chocolate Pudding					
Lemon Cake Pudding					
Fudge Pudding					
Coconut Cream Pudding					
Peanut Butter Chiffon Pudding					
Spice Cake with Pumpkin Icing					
Gelatin and Marshmallow Parfait					
Gelatin Cubes with Topping					
Tropical Lemon Mold with Topping					
Whipped Gelatin					
Orange-Prune Kuchen					

	2 weeks	4 weeks	8 weeks	16 weeks	Never
Heavenly Hash					
Canned Blue Plums					
Grapefruit Half					
Pineapple and Orange Tidbits					
Stewed Phubarb					
Pineapple Chunks					
Baked Apple					
Sliced Strawberries					
Applesauce					
Apricot Halves					
Banana in Orange Juice					
Pear with Meringue					
Cherries					
Boysenberries					

Thank you for your cooperation



Form 4. Evaluation form.

Please consider from palatability aspects only the following sets of three menus.

I For each menu within the set, place a rating (see score key below), in appropriate column under each of the following five characteristics:

(1) texture of foods within the meal,

(2) blending of flavors within the meal,

(3) harmony and variation of colors within the meal,

(4) variety of shape of foods within the meal,

(5) variety in preparation methods of foods within the meal.

II For each set of menus as a whole, indicate with a check mark in the column on right hand side of page, which one menu of the set of three you consider to be most pleasing combination of menu items. For example, in set A, is menu 1, or menu 2, or menu 3 most pleasing?

Score key

5. Excellent combination or variety of foods
4. Good combination or variety of foods
3. Acceptable combination or variety
2. Poor combination or variety
1. Unacceptable combination or variety

DINNER

	Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred
A. Menu 1 Pork Cutlet Mashed Potato Mixed Vegetables Cottage Cheese with Mandarin Slice Angel Delight Pudding						
Score here....						
Menu 2 Pork Cutlet Scalloped Potato Parslied Carrots Orange slices on Parsley Peach Cobbler						
Score here....						
Menu 3 Pork Cutlet Scalloped Potato Whole Kernel Corn Pineapple, marshmallow, grape Salad Strawberries and cookie						
Score here....						
B. Menu 1 Swiss Steak Parsley buttered Potato Asparagus Pickled Beet Angelfood cake and Strawberries						
Score here....						
Menu 2 Swiss Steak French Fries Peas Shimmering Salad Apricot Upside down Pudding						
Score here...						
Menu 3 Swiss Steak Mashed Potato Scalloped Corn Waldorf Salad Peach Shortcake						
Score here....						

DINNER

	Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred (X)
C. Menu 1 Roast Turkey Mashed Potato Stewed Tomato Raspberry Mold Apricot Upside-down Cake						
Score here....						
Menu 2 Roast Turkey Franconia Potatoes Lima Beans Macaroni Salad Chiffon Pie						
Score here....						
Menu 3 Roast Turkey Mashed Potato Harvard Beets Tossed Salad Neopolitan Ice Cream						
Score here....						
D. Menu 1 Baked Sole in Tomato Sauce Rissole Potato Whole Kernel Corn Egg Slice with Asparagus Chocolate Cake						
Score here....						
Menu 2 Baked Sole in Tomato Sauce Scalloped Potato Peas Fruit Juice Gelatin Lemon Cake Pie						
Score here....						
Menu 3 Baked Sole in Tomato Sauce Franconia Potato Squash Relishes (Carrot and celery stick, onion and green pepper) Lady Baltimore Cake						
Score here....						

DINNER

	Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred (X)
E. Menu 1 Barbecued Chicken Parsley buttered Potato ~~au gratin~~ Mixed Vegetables au Gratin Congealed Applesauce on parsley Meringues with chocolate ice cream and chocolate sauce						
Score here.....						
Menu 2 Barbecued Chicken Parsley buttered Potato Green Beans Beets and onions on Spinach Marble Cake						
Score here.....						
Menu 3 Barbecued Chicken Parsley buttered Potato Squash Cabbage Salad Chiffon Pie						
Score here.....						
F. Menu 1 Ham Loaf Creamed Potato Beans ~~Fruit~~ Fruit Cocktail Cherry Glaze Cake						
Score here.....						
Menu 2 Ham Loaf Mashed Potato Peas Tossed Salad Chocolate Cake						
Score here.....						
Menu 3 Ham Loaf Scalloped Potatoes Carrots Tossed Salad Cherry Glaze Cake						
Score here.....						

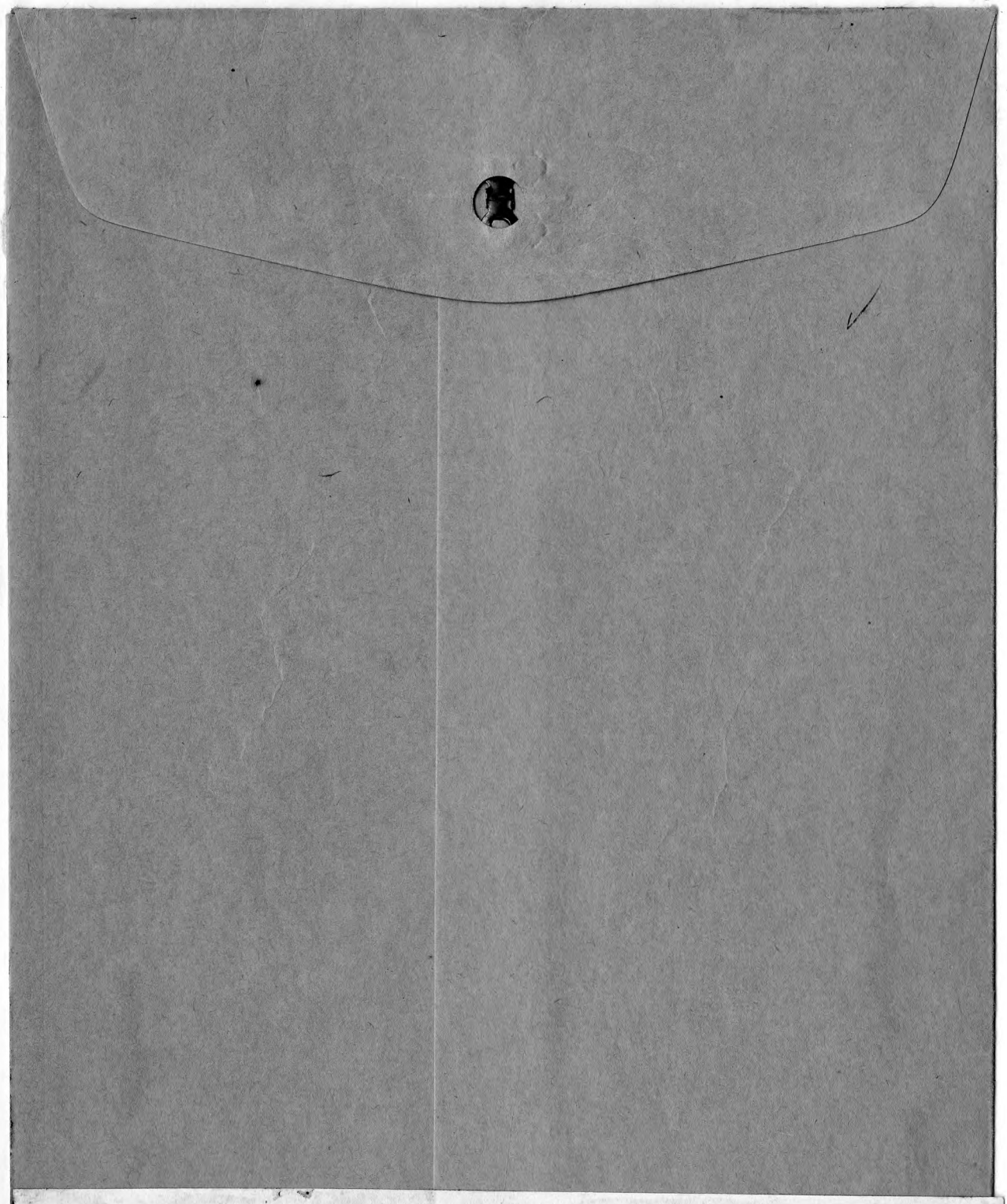
		Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred (X)
	DINNER						
G.	**Menu 1** Roast Beef Creamed Potato Harvard Beet Applesauce Mold Frosted Brownies						
	Score here.....						
	Menu 2 Roast Beef Parsley buttered Potatoes Carrots Beets and onions on Spinach Blueberry Crisp						
	Score here.....						
	Menu 3 Roast Beef Hash brown Potato Parsley buttered Carrots Banana and Orange Salad Apricot Cobbler						
	Score here.....						
	LUNCH						
A.	**Menu 1** Creole Spaghetti German Cucumber on Watercress Tapioca Cream						
	Score here.....						
	Menu 2 Creole Spaghetti Tossed Salad Butterscotch Pudding						
	Score here.....						
	Menu 3 Creole Spaghetti Cucumber in Sour Cream Spice Cake						
	Score here.....						

LUNCH

	Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred (X)
B. Menu 1 Corned Beef Sandwich Tomato and Cucumber Salad Oatmeal Fruit Bar						
Score here.....						
Menu 2 Corned Beef Sandwich Apricot and Banana Salad Butterscotch Pudding						
Score here.....						
Menu 3 Corned Beef Sandwich Lettuce Wedge Ice Cream slice						
Score here.....						
C. Menu 1 Grilled Cheese Sandwich Shredded Lettuce Ice Cream Bar						
Score here.....						
Menu 2 Grilled Cheese Sandwich Egg Slice and Asparagus Chocolate Chip Cookie						
Score here.....						
Menu 3 Grilled Cheese Sandwich Pear Half with Gelatin Cubes Polka Dot Pudding						
Score here.....						
D. Menu 1 Pizza Lettuce Cubes Applesauce parfait						
Score here.....						
Menu 2 Pizza Canned fruit on lettuce Stewed Rhubarb						
Score here.....						
Menu 3 Pizza Tomato and Cucumber Apricot Whip						
Score here.....						

LUNCH

	Texture	Flavor	Color	Shape	Prep Variety	Check menu preferred (X)
E. Menu 1 Ham salad sandwich Peach half with Prune center Tapioca Cream						
Score here....						
Menu 2 Ham salad sandwich Rhubarb Mold Gingerbread with Topping						
Score here....						
Menu 3 Ham salad Sandwich Garden Salad Tapioca Pudding						
Score here....						
F. Menu 1 Bacon, Lettuce, Tomato Sandwich Lime Gelatin and Pear Fudge Pudding						
Score here....						
Menu 2 Bacon, Lettuce, Tomato Sandwich Melon Cubes Tropical Lemon Mold Ambrosia						
Score here....						
Menu 3 Bacon, Lettuce, Tomato Sandwich Mixed Vegetable Salad Rice Krispy Cookie						
Score here....						
G. Menu 1 Cheese Souffle Macaroni Salad Pineapple Chunks						
Score here....						
Menu 2 Cheese Souffle Pickled Egg Slices on Spinach Tropical Lemon Mold						
Score here....						
Menu 3 Cheese Souffle Celery and Beet Baked Apple						
Score here....						



Form 5. Computer program.

```
C     R A N D O M  M E N U  P R O G R A M.                          KSU
      DIMENSIONMATRIX(8,5),IFD(8),IMIN(7),IMAX(7),INAME(200,6),ICHAR(200
     1,6)
      DIMENSIONCOST(200)
    1 FORMAT(6A5,F2.2,2X,5I1)
   21 FORMAT(89X,4H----/77X,5HTOTAL,6X,1H$,F4.2)
   20 FORMAT(/1X,14X,6A5,8X,I1,7X,I1,5X,I1,5X,I1,6X,I1,7X,1H$,F4.2)
   23 FORMAT(1H1,52X,29HC H A R A C T E R I S T I C S/15X,19HMENU ITEM S
     1ELECTION,16X,34HTEXTURE FLAVOR COLOR SHAPE VARIETY,5X,4HCOST/15X,
     219(1H-),16X,34(1H-),5X,4(1H-))
      WRITE(3,23)
      ISEC=0
      ICNF=0
      IARG=485
      N=1
      DO2M=1,7
      IMIN(M)=N
    3 READ(1,1)(INAME(N,J),J=1,6),COST(N),(ICHAR(N,J),J=1,5)
      IF(INAME(N,1).EQ.0)GOTO2
      IMAX(M)=N
      N=N+1
      GOTO3
    2 CONTINUE
      IDOMIN=IMIN(3)
      IDOMAX=IMAX(7)
      DO100NTR=1,7
      DO5NZ=IDOMIN,IDOMAX
    5 ICHAR(NZ,6)=0
      DO100NT3=1,3
      DO6I=1,8
      DO6N=1,5
    6 MATRIX(I,N)=0
      DO9I=1,3
    8 IFD(I)=IRANDM(IARG)
      IFD(I)=IFD(I)/100
      IF(IFD(I).LT.IMIN(I))GOTO8
      IF(IFD(I).GT.IMAX(I))GOTO8
      ISEL=IFD(I)
      IF(ICHAR(ISEL,6).EQ.1)GOTO8
      ICHAR(ISEL,6)=1
      DO9N=1,5
    9 MATRIX(I,N)=ICHAR(ISEL,N)
      I=4
   11 IFD(I)=IRANDM(IARG)
      IFD(I)=IFD(I)/100
      IF(IFD(I).LT.IMIN(I))GOTO11
      IF(IFD(I).GT.IMAX(I))GOTO11
      ISEL=IFD(I)
      IF(ICHAR(ISEL,6).EQ.1)GOTO11
   16 DO12N=1,5
   12 MATRIX(I,N)=ICHAR(ISEL,N)
      DO13K=1,5
      ICSUM=0
      DO14J=1,7
      ITEST=I-J
      IF(MATRIX(I,K).NE.MATRIX(ITEST,K))GOTO27
      ICSUM=ICSUM+1
      IF(ICSUM.GT.2)GOTO15
   27 IF(ITEST.EQ.1)GOTO13
   14 CONTINUE
   13 CONTINUE
   19 ICHAR(ISEL,6)=1
   28 ICNF=0
      I=I+1
      IF(I.GT.7)GOTO30
      GOTO11
   15 IFD(I)=IFD(I)+1
      IF(I.EQ.8)GOTO10
      IF(IFD(I).GT.IMAX(I))GOTO25
      GOTO33
   10 IF(IFD(8).GT.IMAX(7))GOTO25
   33 ISEL=IFD(I)
      IF(ICHAR(ISEL,6).EQ.1)GOTO15
      GOTO16
   25 IF(ICNF.EQ.1)GOTO26
```

```
      IF(I.EQ.8)GOTO34
      IFD(I)=IMIN(I)
      GOTO35
   34 IFD(8)=IMIN(7)
   35 ISEL=IFD(I)
      ICNF=1
      IF(ICHAR(ISEL,6).EQ.1)GOTO15
      GOTO16
   26 ICNF=0
      IFD(I)=200
      GOTO28
   30 IF(ISEC.EQ.1)GOTO32
   31 IFD(8)=IRANDM(IARG)
      IFD(8)=IFD(8)/100
      IF(IFD(8).LT.IMIN(7))GOTO31
      IF(IFD(8).GT.IMAX(7))GOTO31
      ISEL=IFD(8)
      IF(ICHAR(ISEL,6).EQ.1)GOTO31
      ISEC=1
      I=8
      GOTO16
   32 ISEC=0
      ISUB1=IFD(1)
      ISUB2=IFD(2)
      ISUB3=IFD(3)
      ISUB4=IFD(4)
      ISUB5=IFD(5)
      ISUB6=IFD(6)
      ISUB7=IFD(7)
      ISUB8=IFD(8)
      TOTCST=COST(ISUB2)+COST(ISUB4)+COST(ISUB8)
      WRITE(3,20)(INAME(ISUB2,I),I=1,6),(ICHAR(ISUB2,I),I=1,5),COST(ISUB
     12)
      WRITE(3,20)(INAME(ISUB8,I),I=1,6),(ICHAR(ISUB8,I),I=1,5),COST(ISUB
     18)
      WRITE(3,20)(INAME(ISUB4,I),I=1,6),(ICHAR(ISUB4,I),I=1,5),COST(ISUB
     14)
      WRITE(3,21)TOTCST
      TOTCST=COST(ISUB1)+COST(ISUB3)+COST(ISUB5)+COST(ISUB6)+COST(ISUB7)
      WRITE(3,20)(INAME(ISUB1,I),I=1,6),(ICHAR(ISUB1,I),I=1,5),COST(ISUB
     11)
      WRITE(3,20)(INAME(ISUB3,I),I=1,6),(ICHAR(ISUB3,I),I=1,5),COST(ISUB
     13)
      WRITE(3,20)(INAME(ISUB6,I),I=1,6),(ICHAR(ISUB6,I),I=1,5),COST(ISUB
     16)
      WRITE(3,20)(INAME(ISUB7,I),I=1,6),(ICHAR(ISUB7,I),I=1,5),COST(ISUB
     17)
      WRITE(3,20)(INAME(ISUB5,I),I=1,6),(ICHAR(ISUB5,I),I=1,5),COST(ISUB
     15)
      WRITE(3,21)TOTCST
  100 CONTINUE
      STOP
      END
```

AUTOMATED MENU PLANNING

by

ROBIN MARY BROWN

Diploma of Home Science
University of Otago, New Zealand, 1961

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Institutional Management

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1966

ABSTRACT

Automation and data processing techniques have been accepted by many major industries and recognized as a force changing methods of management. Administrative capabilities have been extended because these management tools perform highly repetitive tasks in a minimum of time. In the past, the food service industry has been slow to apply new management applications. However, it is facing an acute shortage of management personnel and should be receptive to the implications of computer potentialities.

Menu planning is an example of a repetitive, time-consuming task of food service management. Recently, linear programming techniques have been developed to plan economical, nutritionally-adequate menus on a computer. Other factors such as texture, flavor, color, shape, and preparation methods of foods are important considerations in the planning of good menus suitable for food services. The storage capabilities, or memory, of the computer should make it a valuable instrument in menu planning.

Emphasizing palatability, an approach to planning menus suitable for residence halls was attempted on a computer, using random selection techniques. Data used for computer input consisted of selected menu items served in residence halls at Kansas State University, raw food costs, serving frequency ratings, and menu classification ratings. Each menu item was coded with a five digit number related to

texture, flavor, color, shape, and method of preparation. Restrictions were placed on the number of times that each characteristic could appear in one day, and on the appearance of certain classes of menu items. Recommended nutritional allowances were fulfilled by establishing a menu pattern compatible with recommendations of United States Department of Agriculture (1964). Each day's menu included lunch and dinner meals only.

Menus for 21 days, using 152 foods divided into seven categories, were planned. From these 21 menus, seven were selected for evaluation study. Each of the seven computer menus was compared with two residence hall menus featuring the same entree by a panel of dietitians. Preference for computer-planned menus was indicated in five out of 14 instances.

The menus presented as computer output demonstrated that approaches to menu planning by computer through aspects of palatability and use of random selection techniques were feasible. However, palatability codes will require further development and refinement, and selection lists for menu items will need expansion in order to improve computer output.