You are to solve the Basic Problem in two ways, and also solve the Enhanced Problem.

**Basic Problem:** Cardinal Nut Shop currently makes two mixes of nuts. A container of "Denny Crum" mix has 8 oz of peanuts, 4 oz of cashews, 5 oz of hazelnuts, and 3 oz of pecans, and sells for $20.00. A container of "Rick Pitino" mix has 3 oz of peanuts, 3 oz of cashews, 6 oz of hazelnuts, and 8 oz of macadamia nuts, and sells for $21.50. Each oz of peanuts costs $0.50, each oz of cashews and hazelnuts costs $0.60, each oz of pecans costs $1.20, and each oz of macadamia nuts costs $0.70. The Shop has available this week 652.5 pounds of peanuts, 412.5 pounds of cashews, 723.75 pounds of hazelnuts, 219.375 pounds of pecans, and 825 pounds of macadamia nuts. How many containers of each type of mix should be made from the available supplies to maximize profit?

1. Formulate the Basic Problem by completing items (a) – (d) below.
   (a) Define the production variables, including their units.
   (b) Determine the profit on a container of each type of mix, and an equation for the total profit this week, in terms of the production variables. (Note: The profit on a container of mix is defined to be its selling price minus the total cost of the nuts included in the container.)
   (c) Give a product/resource chart organizing the data about the products and the resources, and
   (d) Give a mathematical formulation of the constraints in terms of your production variables.

2. Carefully graph the feasible region on the attached graph paper. Be sure the scales on your axes start at 0 and the graph is large enough see the entire feasible region clearly.
   (e) Label all the corner points and determine their coordinates. Show your work.
   (f) Use the corner points to find the production policy (number of containers of each type of mix) for this week that gives the maximum total profit and what that maximum profit is. Show your work and describe your results in sentence form.

3. Use the Math 105 computational software (see attached) to solve the Basic Problem a second way.
   (g) Give the names of the slack variables that are introduced and their meaning. Use the slack variables to rewrite the constraints as equalities. Rewrite the profit function in the form for the initial matrix.
   (h) Attach printouts of the initial and final simplex matrices from the computer program with your group members names entered.
   (j) What are the values of all the variables in the final matrix?
   (k) Answer the following in complete sentences:
      What is the maximum profit Cardinal Nut Shop can realize this week?
      How many containers of each type mix should the company make to attain this maximum profit?
      (This should agree with your answer obtained graphically in 2.)
      If the Nut Shop pursues this production policy, how much of each resource will be unused?

**Enhanced Problem** Cardinal Nut Shop is considering adding a "Steve Kragthorpe" mix to its product line. One container of this mix has 6 oz peanuts, 4 oz cashews, 4 oz hazelnuts, 2 oz pecans, and 4 oz macadamia nuts, and sell for $20. If they offer this mix, how many containers of each of the three types of mixes should be made from the available supplies in order to maximize profit?

4. Help Cardinal Nut Shop decide whether to offer the "Steve Kragthorpe" mix. Solve the Enhanced Problem. Perform steps in Problems 1. and 3. above with this type mix as one of their mixes. (Do not attempt a graphical solution.) Your solution should include a statement of the number of containers of each type mix that the Nut Shop should make to maximize their profit, and the amount of each resource that will be unused if those numbers of containers are produced. Would Cardinal Nut Shop make a larger profit if they offered the “Steve Kragthorpe” mix? Justify your answer.

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