

Question 1

The Rotary Club is holding a pizza sale to finance outreach projects. The Club made an agreement to purchase pizza from Pizza Hut at a 30% discount which the Rotary Club can then resell for a profit. It is expected that of the 500 families in the community, at most 70% will buy pizza. Based on a survey of their personal preferences, the students believe that they should order no more than 120 cheese pizzas, no more than 150 pepperoni pizzas, and no more than 100 vegetarian pizzas. They also want to make sure that at least 20% of the total pizzas are cheese and at least 50% of the pizzas are pepperoni. The standard price (before discount) for the cheese, pepperoni and vegetarian is \$12, \$15 and \$14, respectively. The Rotary Club makes a profit of 10%, 15% and 20%, respectively, for each cheese, pepperoni, and vegetarian pizza they resell.

- a) Formulate a linear programming model that would determine the optimal solution. ***An explanation for the derivation of EACH equation should be provided.***
- b) Set up and solve the linear programming model using EXCEL. (Both the excel set up and answer report are required)

Question 2

Due to heavy rains that destroyed numerous roadways in Jamaica the National Works Agency (NWA) has decided to repair 300 km of the Southern Coastal Highway and 200 km of Type A roads from Kingston to Lucea. The repair will cost \$2 million per km for the Type A roads and \$8 million per km for the Southern Coastal Highway. The NWA has identified two firms China Harbour and Caribbean Construction. Caribbean Construction can repair at most 300 km while China Harbour has no restriction on the amount of roadway it can repair. Each company must be awarded a contract of at least \$300 million (before discounts).

Each company wants to maximize the quantity of highway and Type A roads awarded by the NWA so are willing to offer a per km discount. China Harbour offers a discount of 1% for each km of Southern Coastal Highway and Type A road. Caribbean Construction offers a flat discount of \$30,000 for each km of Type A road and \$50,000 for each km of the Southern Coastal

Highway. Due to a significant budget shortage the NWA wants to maximize the total discount received from the two companies. Let x and y represent the number of kilometres of Type A roads and Southern Coastal Highway.

- a) Determine the objective function. *Provide an explanation.*

- b) Formulate a linear programming model. *An explanation for the derivation of EACH equation should be provided.*

- c) Use the extreme point theorem to solve the LP. *Ensure that you explain the steps taken.*

Question 3

Supreme Ventures Limited is a major gambling company in the Caribbean. Last year Supreme Ventures had budgeted up to \$8,000 per week for local advertising. The money was allocated among four promotional media: tv spots, newspaper ads, and two types of radio advertisements. Supreme Ventures goal is to reach the largest possible high-potential audience through the various media at the lowest cost possible. The following table presents the number of potential gamblers reached by making use of an advertisement in each of the four media. It also provides the cost per advertisement placed and the maximum number of ads that can be purchased per week.

Medium	Audience Reached per Ad	Cost per Ad \$	Maximum Ads per Week
TV spot (1 min)	5,000	800	12
Daily newspaper (full-page ad)	8500	925	5
Radio spot (30 sec, primetime)	2400	290	25
Radio spot (1min afternoon)	2800	380	20

Supreme Ventures contractual arrangements require that at least 5 radio spots be placed each week. In addition, the firm wants to reach at least 67,000 persons through all media.

- Formulate a linear programming model that would determine the optimal solution. ***An explanation for the derivation of EACH equation should be provided.***
- Set up the initial simplex table. ***Ensure that you explain the steps taken.***
- Use the simplex method to solve the LP. ***Ensure that you explain the steps taken.***