Please answer the following questions giving all details.

Questions 1 and 3: 1.2 Points each

Question 2: 1.6 Points

1. The Charm City recently purchased a 35 acre of farm land, and it has $500,000 budgeted to develop recreational facilities. They are considering the facilities for soccer fields, swimming pool, walking trails, and a children’s playground to develop. The following table shows the amount of acreage required by each project, the annual expected usage for each facility, and the cost to construct each facility. Also included is a priority designation determined by the town’s recreation committee based on several public hearings and their perceptions of the critical need of each facility.

**Facility Annual Usage (people) Acres Cost ($) Priority**

Swimming pool 15,000 6 125,000 1

Soccer fields 12,000 10 120,000 2

Playground 32,000 14 150,000 1

Walking trails 30,000 22 90,000 1

The total priority level cannot be more than 3. At least 2 facilities must be selected. Formulate a **capital budgeting** problem that will maximize the total annual usage by determining:

(a) The decision variables.

(b) The objective function. What does it represent?

(c) All the constraints. What does each constraint represent?

**Note: Do NOT solve the problem after formulating.**

2. The director of career advising at the Charm City Community College wants to use decision analysis to provide information to help students decide which 2-year degree program they should pursue. The director has set up the following payoff table for four of the most popular and successful degree programs at the college that shows the estimated 5-year gross income (in thousands of dollars) from each degree for three future economic conditions:

 **Economic Condition**

**Degree Program Recession Average Good**

Graphic design 140 160 160

Nursing 120 180 200

Real estate 110 180 220

Medical technology 150 150 150

Determine which 2-year degree program to pursue and the profit associated with it by finding the optimal decision using the following decision criteria:

a.Maximax

b.Maximin

c.Equal likelihood

d. Minimax regret

3. For the problem given in Question 2, the probabilities for the economic conditions are given by P(Recession) = 0.2, P(Average) = 0.5, and P(Good) = 0.3.

a.Compute the expected value for each decision and select the best one.

b.Compute the expected regret value for each decision and select the best one.

c. Calculate and interpret the expected value of perfect information.

4. A single-server queuing system with an infinite calling population and a first-come, first-served queue discipline has the following arrival and service rates:

λ = 70 customers per hour

µ = 100 customers per hour

Determine P1, P3, L, Lq, W, Wq, and U.

**Note:** Do hand calculations to answer this question.

5. An immigration agent at an airport, on an average, could process 14 entrants in one hour, if he was busy all the time. On an average, an entrant arrives at his station at every 5 minutes. The agent can be replaced by a more efficient specialist. The specialist can process 18 entrants in one hour. The specialist is paid $45 per hour whereas the current agent is paid $30 per hour. If an entrant’s time is considered to be worth $10 per hour, is it worth to replace the agent with the specialist?

**Note:** Do hand calculations to answer this question.

6. A grocery store has three check-out counters. The average service rate for each check-out counter is 25 customers per hour. The average arrival rate is 60 customers per hour. Assuming it is a multiple-server waiting line model; determine the average number of customers waiting for a check-out counter and the average time a customer must wait for a check-out counter. What is the probability that there will be less than or equal to 4 customers in the system?

**Note:** Use QM for Windows to answer this question.