RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester II Examination – October/November 2017

MAT 3205 – INTRODUCTION TO STATISTICAL DECISION THEORY

Time: Two (02) hours

Answer all questions
Calculators will be provided

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1. A corporation is considering a new production process that, if efficient will save the corporation $350,000. If it is not efficient, the amount of lost sales plus the expense of converting to the new process and then reconverting to the old will come to $925,000.

   a) Determined the recommended decision (convert or not) if the company feels that the new process has an 80% chance of being efficient. **(20 marks)**

   b) The corporation has a third option available to it; integrating a testing stand-alone phase of the new process into the current process and check its results before deciding whether to convert. The cost of testing stand-alone phase is $125,000, of which $75,000 is recoverable if the new process is adopted. If the testing stand-alone phase is not favorable, then an additional $25,000 in sales is lost during the test.
   If entire new process is efficient, then the testing stand-alone phase should operate favorably with probability 0.99. If the entire new process in not efficient, the testing stand-alone phase could operate favorably, and the company estimates this would happen with probability 0.6. Determine the recommended decisions by using Bayesian Analysis. **(80 marks)**

2. You own a pizza shop in a downtown mini-mall. It is Saturday morning, and you are trying to decide how many pizzas to make to meet today's lunch hour demand. Based upon your experience with Saturdays, you think that the probability of being able to sell 20 pizzas is 0.2, of being able to sell 40 pizzas is 0.3, and of being able to sell 50 pizzas is 0.5.

   Suppose a pizza sells for \$10 and has a cost of \$4.25. If you have leftover pizzas, you can sell them to the homeless shelter for \$1.25 each. If demand exceeds the number of pizzas you have prepared, every disappointed customer costs you \$0.25 worth of lost customer goodwill.

   a) Assume you do not have the probability knowledge and identify the decision you would make using each of the following criteria:
      i. Maximax
      ii. Maximin **(60 marks)**

   b) Use Expected Monitory Value (EMV) criterion to determine the optimal decision. **(25 marks)**

   c) Evaluate the Expected Value of Perfect Information (EVPI). **(15 marks)**

3.

   a) Consider the following notations in Inventory Control:

      q – order quantity
      R – demand rate
      t – ordering cycle length
      C_s – setup cost
      C_h – stock holding cost

      If the demand rate is uniform and replenishment rate is infinite, show that the optimum inventory policy is $q_0 = \sqrt{\frac{2C_sR}{C_h}}$ units and $t_0 = \sqrt{\frac{2C_s}{C_hR}}$ time units. **(60 marks)**

   b) A certain item is replaced at a rate of 100 units per day. The company makes orders periodically and it costs \$100 per order. The item keeping cost in storage is estimated as \$0.02 per unit per day. The lead time between placing and receiving an order is 12 days. Determine the optimal inventory policy. **(40 marks)**

4.

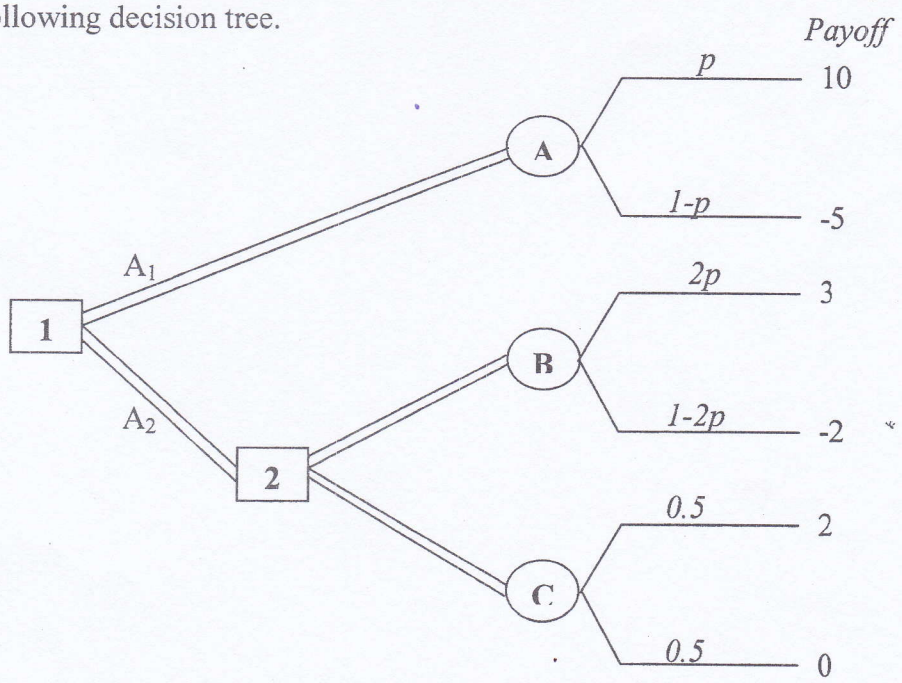
a) A company is deciding whether to develop and launch a new product. Research and development costs are expected to be \$400,000 and there is a 70% chance that the product launch will be successful, and a 30% chance that it will fail. If it is successful, the levels of expected profits and the probability of each occurring have been estimated as follows, depending on whether the product's popularity is high, medium or low:

Popularity	Probability	Profits (\$)
High	0.2	1000,000
Medium	0.5	800,000
Low	0.3	600,000

If it is a failure, there is a 0.6 probability that the research and development work can be sold for \$50,000 and a 0.4 probability that it will be worth nothing at all. Construct a decision tree for the entire decision process and determine the recommended actions.

(60 marks)

b) Suppose that you want to choose between action A_1 and action A_2 for given p in the following decision tree.



Your utility function $u(M)$ for the amount of money (payoff) is given by;

$$u(M) = \begin{cases} M^2, if \ M \geq 0 \\ M, \ if \ M < 0 \end{cases}$$

For the value $p = 0.25$, of the probability determine the action that maximizes the expected utility of payoff.

(40 marks)

END