



UNIVERSITY OF ESWATINI

SECOND SEMESTER RESIT EXAMINATION PAPER, DEC 2021

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF STATISTICS AND DEMOGRAPHY

COURSE CODE: STA 408

TITLE OF PAPER: OPERATIONS RESEARCH 2

TIME ALLOWED: 2 HOURS

Instructions

1. Answer Any 3 (Three) Questions Of Your Choice.
2. All Questions Carry Marks As Indicated Within The Parenthesis

Special Requirements

1. Scientific calculator

*Candidates may complete the front cover of their answer book when instructed by the Chief Invigilator and sign their examination attendance cards but must **NOT** write anything else until the start of the examination period is announced.*

No electronic devices capable of storing and retrieving text, including electronic dictionaries and any form of foreign material may be used while in the examination room.

DO NOT turn examination paper over until instructed to do so.

QUESTION ONE**[5+5+10]**

- a. Given the profit payoff table given below, suppose the manager has assigned probabilities of 0.2 to the occurrence of state # 1, 0.5 to the occurrence of state and 0.3 to occurrence state #3.

Alternative	State of Nature		
	#1	#2	#3
A	E12,000	E18,000	E15,000
B	E17,000	E10,000	E14,000
C	E22,000	E16,000	E10,000
D	E14,000	E14,000	E14,000

- Which alternative would you choose using the Expected Value Criterion?
 - Calculate the expected value of perfect information using (1) the expected payoff under certainty approach and (2) the expected regret approach.
- b. A manager must decide how many machines of a certain type to buy. The manager has narrowed the decision to two alternatives: (1) buy one machine or (2) buy two machines. If only one machine is purchased and demand is more than the company can handle, then a second machine will be purchased at a later date. However, the cost per machine would be lower if two machines were to be purchased at the same time. The initial purchase of the two machines has a net value of E75,000 if demand is low and E140,000 if demand is high. The probability of low demand is 0.45. The initial purchase of one machine has a net value of E85,000 if demand is low, If demand is high, and the company decides to purchase machine initially, the manager has three options. The first option is to do nothing with a net value of E85,000. The second option is to subcontract. If the firm decides to subcontract, there is a 65% chance of using vendor X with a net return of E100,000. There is a 35 % chance of using vendor Y with a net return of E135,000. The third option is to purchase a second machine with a net value of R115,000. How many machines should the firm purchase initially and why? Use a decision tree to analyse the problem.

QUESTION TWO**[10+10]**

- a. A complex airborne navigating system incorporates a subassembly which unrolls a map of the flight plan synchronously with the movement of the aeroplane. This subassembly is bought on very good terms from a subcontractor, but is not always in perfect adjustment on delivery. The subassemblies can be readjusted on delivery to guarantee accuracy of R500 per

subassembly. It is not, however, possible to distinguish visually those subassemblies that need adjustment.

Alternatively, the subassemblies can each be tested electronically at a cost of R100 per subassembly tested. Past experience shows that about 30% of those supplied are defective; the probability of the test indicating a bad adjustment when the subassembly is faulty is 0.8, while the probability that the test indicates a good adjustment when the subassembly is properly adjusted is 0.7. If the adjustment is not made and the subassembly is found to be faulty when the system has final check, the cost of subsequent rectification will be R1,400. Draw up an appropriate decision tree to show the alternatives open to the purchaser and use it to determine his appropriate course of action

b. Solve the problem

$$\begin{aligned} \text{maximize} \quad & Z = 5X_1 + 12X_2 + 4X_3 \\ \text{Subject to} \quad & X_1 + 2X_2 + X_3 \leq 5 \\ & 2X_1 - X_2 + 3X_3 = 2 \\ & X_1, X_2, X_3 \geq 0 \end{aligned}$$

QUESTION THREE

[10+5+5]

The utility data for a network are given below.

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

- Draw the network diagram
- Determine the minimum time to complete the project.
- Identify the critical path

QUESTION FOUR

[6+3+3+2+3+3]

a. A branch of Punjab national Bank has only one typist. Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8 hour work day. If the typewriter is valued at R1.5 per hour, determine

- Equipment utilization
- The per cent time that an arriving letter has to wait

- iii. Average system time
 - iv. Average cost due to waiting on the part of typewriter, i.e it remaining idle
- b. A person repairing radios finds that the time spent on the radio sets has exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8 hour day,
- i. What is the repairmen's expected idle time each day?
 - ii. How many jobs are ahead of the average set just brought in?

QUESTION FIVE**[20]**

A manufacturer has entered into a contract for the supply of the following number of units of a product at the end of each month. The units manufactured during a month are available for supply at the end of the month or they may be kept in storage at a cost of R2 per unit per month. Each time the manufacture of a batch of units is undertaken; there is a set – up cost of R400. Determine the production schedule which will minimize the total cost

Month	Jan	March	August	October	November	December
Number of units	10	5	20	3	6	30

END OF EXAMINATION