



UNIVERSITY OF ESWATINI

SECOND SEMESTER MAIN EXAMINATION PAPER, AUGUST 2020

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**[8+3+3+3+3]**

a. Maximize $Z = 4X_1 + 3X_2 + 6X_3$,

$$\begin{aligned} \text{Subject to } & 2X_1 + 3X_2 + 2X_3 \leq 440 \\ & 4X_1 + 3X_3 \leq 470 \\ & 2X_1 + 5X_2 \leq 430 \\ & X_1, X_2, X_3 \geq 0 \end{aligned}$$

b. The following matrix gives the payoff of different strategies S_1, S_2, S_3 against conditions N_1, N_2, N_3 and N_4 .

	N_1	N_2	N_3	N_4
S_1	₹ 4,000	₹ - 100	₹ 6,000	₹ 18,000
S_2	20,000	5,000	400	0
S_3	20,000	15,000	- 2,000	1,000

Indicate the decision taken under the following approach:

- i. Pessimistic
- ii. Optimistic
- iii. Regret
- iv. Equal probability

QUESTION TWO**[20]**

A company is currently working with a process, which after paying for materials, labour, etc brings a profit of R12,000. The company has the following alternatives:

- The company can conduct research R1 which is expected to cost R10,000 and has 90% probability of success. If successful, the gross income will be R26,000.
- The company can conduct research R2, expected to cost R6,000 and has a probability of 60% success. If successful, the gross income will be R24,000.
- The company can pay R5,000 as royalty of new process which will bring a gross income of R20,000
- The company may continue the current process.

Because of limited resources, only one of the two types of research can be carried out at a time. Draw the decision tree and find the optimal strategy for the company

QUESTION THREE**[5+2+2+3+8]**

The following table gives data on normal time and crash time and cost for a project.

Activity	Normal		Crash	
	Time (weeks)	Cost (R)	Time (weeks)	Cost (R)
1 – 2	3	300	2	400
2 – 3	3	30	3	30
2 – 4	7	420	5	580
2 – 5	9	720	7	810
3 – 5	5	250	4	300
4 – 5	0	0	0	0
5 – 6	6	320	4	410
6 – 7	4	400	3	470
6 – 8	13	780	10	900
7 – 8	10	1,000	9	1,200
		4,220		

Given that Indirect costs are R50 per week, answer the following :

- i. Draw the network
- ii. Identify the critical path
- iii. What is the normal duration and associated cost?
- iv. Find out the total float for each activity.
- v. Crash the relevant activities systematically and determine the optimum project time and cost.

QUESTION FOUR**[3+3+3+3+4+4]**

A self – service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the chaiser can serve 10 customers in 5 minutes. Assuming Poission distribution for arrival rate and exponential distribution for service time, find

- a) Average number of customers in the system
- b) Average number of customers in the queue or average queue length
- c) Average time a customer spends in the system
- d) Average time a customer waits before being served

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,

- a) what is the repairmen's expected idle time each day?
- b) How many jobs are ahead of the average set just brought in?

QUESTION FIVE

[20]

A firm has divided its marketing area into three zones. The amount of sales depends upon the number of salesmen in each zone. The firm has been collecting the data regarding sales and salesmen in each area over a number of past years. The information is summarised below.

No of salesmen	Zone 1	Zone 2	Zone 3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110
8	100	100	110
9	90	100	110

For the next year the firm has only 9 salesmen and the problem is to allocate these salesmen to three different zones so that the total sales are maximum. How will these 9 be allocated to three different zones so that the total sales are maximum?

END OF EXAMINATION