

DEPARTMENT OF STATISTICS AND DEMOGRAPHY

MAIN EXAMINATION, 2008/9

COURSE TITLE: OPERATIONS RESEARCH II

COURSE CODE: ST 408

TIME ALLOWED: TWO (2) HOURS

**INSTRUCTION: ANSWER ANY FOUR QUESTIONS
ALL QUESTIONS CARRY EQUAL MARKS (15 MARKS)**

SPECIAL REQUIREMENTS: SCIENTIFIC CALCULATORS AND STATISTICAL TABLES

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INVIGILATOR**

Question 1

(a) Sifuba Investment uses 48, 000 rubber wheels per year for manufacturing its popular toy truck toy series. The firm makes its own wheels, which it can produce at a rate of 800 per day. The toy trucks are assembled uniformly over the entire year. Carrying cost is E1 per wheel a year. Set-up cost for a production run of wheels is E45. The firm operates 240 days per year. Determine the:

- (i) Optimum run size.
- (ii) Minimum total annual cost for carrying and set-up.
- (iii) Cycle time for the optimal run size and run time.

(3+3+3 marks)

(b) A manager of a construction supply house determined from historical records that demand for sand during lead time averages 60 tons. In addition, the manager determined that that demand during lead time could be described by a normal distribution with a mean of 60 tons and a standard deviation of 3 tons. Calculate the following, assuming that the manager is willing to accept a stock-out risk of no more than 3%:

- (i) What value of z is appropriate?
- (ii) How much safety stock should be held?
- (iii) What reorder point should be used?

(2+2+2 marks)**Question 2**

A major consumer goods manufacturer wishes to decide which of two new products to bring out in the market and what level of advertising to use. The profit table for these products is as follows (Profits are in thousands of Emalangeni)

Demand	Product 1			Product 2		
	A ₁	A ₂	A ₃	A ₁	A ₂	A ₃
S ₁ : High	140	160	200	200	210	230
S ₂ : Average	100	130	160	160	170	190
S ₃ : Low	80	120	140	120	130	140

The Prior probability distributions of demand are:

S _i	Product 1 P(S _i)	Product 2 P(S _i)
S ₁	0.4	0.2
S ₂	0.5	0.2
S ₃	0.1	0.6

- (a) Which product and advertising level would you recommend? **(10 marks)**
- (b) What is the expected value of perfect information for each product? **(5 marks)**

Question 3

Estimated times of the jobs of a project are given below:

Job:	A	B	C	D	E	F	G	H	I	J	K	L
Time:	13	5	8	10	9	7	7	12	8	9	4	17

The constraints governing the jobs are as follows:

A and B are start jobs; A controls C, D and E; B controls F and J; G depends on C; H depends on D; I and L are controlled by E and F, K depends on J; L is also controlled by K; G, H, I and L are the last jobs.

- Draw an (AOA) network diagram for this project,
- Determine slack for each activity and
- Find the project duration and the critical path.

(5+5+5 marks)

Question 4

(a) A businessman has two independent investments, A and B available to him, but lacks the capital to undertake both of them simultaneously. He can choose to take A first and then stop, or if A is successful, then take B or vice versa. The probability of a success for A is 0.7, while for B, it is 0.4. Both investments require an initial capital of E2 000 and both return nothing if the venture is unsuccessful. Successful completion of A will return E3 000 (over cost), and successful completion of B will return E5 000 (over cost). Draw the decision tree and determine the best strategy.

(8 marks)

(b) A company owns a lease on a certain property. It may sell the lease for E72 000 or it may drill the said property for oil. Various possible drilling results along with their probabilities and expected payoffs are given below:

Possible result	Probability	Payoff
Dry well	0.10	-100 000
Gas well only	0.40	45 000
Oil and gas combination	0.30	98 000
Oil well	0.20	199 000

Draw a decision tree for the above problem and calculate EMV for each option. Should the company drill or sell?

(7 marks)

Question 5

A repairman is to be hired to repair machines which break down at an average of 3 per hour. The breakdowns follow Poisson distribution. Non-productive time of a machine is considered to cost the company E16 per hour. Two repairmen have been interviewed: one is slow but cheap while the other is fast but expensive. The slow repairman charges E80 per hour and he services broken-down machines at a rate of 4 per hour. The fast repairman demands E100 per hour and he services at an average rate of 6 per hour. Which repairman should be hired?
(15 marks)

END OF EXAM!!

