

UNIVERSITY OF SWAZILAND

DEPARTMENT OF STATISTICS AND DEMOGRAPHY

SUPPLEMENTARY 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

The time estimates (in weeks) for the activities of a project are given below:

<u>Activity</u>	<u>Optimistic time</u>	<u>Most likely time</u>	<u>Pessimistic time</u>
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- a) Draw the project network and identify all paths through it.
- b) Determine the expected project length
- c) Calculate the standard deviation and variance of the project length
- d) What is the probability that the project will be completed?
 - i) at least 4 weeks earlier than expected time
 - ii) no more than 4 weeks later than expected time
- e) If the project due date is 19 weeks, what is the probability of not meeting the due date?

Question 2

A jewelry firm buys semiprecious stones to make bracelets and rings. The supplier quotes a price of \$8 per stone for quantities of 600 stones or more, \$9 per stone for orders of 00 to 599 stones, and \$10 per stone for lesser quantities. The jewelry firm operates 200 days per year. Usage rate is 25 stones per day, and ordering costs are \$48.

- a) If carrying costs are \$2 per year for each stone, find the order quantity that will minimize total annual cost.
- b) If annual carrying costs are 30 percent of unit cost, what is the optimal order size

Question 3

A bank has a drive-in window, which is open from 10 a.m. to 3 p.m. on business days. Customers drive up at a mean rate of 12 per hour, according to a Poisson distribution. The teller requires a mean of 2.4 minutes to serve each customer. Service times have a negative exponential distribution.

- a) What is the system utilization? Is this a feasible system?
- b) What is the proportion of idle time?
- c) What is the mean number of customers being served?
- d) What is the expected number of customers waiting for service?
- e) What is the expected duration of the wait?
- f) What is the mean number of customers in the system?
- g) What is the probability that the system will be idle?

Question 4

An investment trust manager wishes to buy a portfolio of shares and he has sufficient funds to buy either Portfolio A, portfolio B or Portfolio C. The potential gain from the portfolios will depend upon the level of economic activity in the future, and the following estimates have been made (all figures in E000):

Portfolio	State of Nature		
	Expansion	Stability	Contraction
A	100	50	-50
B	50	100	-25
C	-50	0	180

- a) Which portfolio should be selected if the manager applies:
 - i) The maximax criterion
 - ii) The maximin criterion
 - iii) The minimax criterion
- b) Suppose that the manager makes the following probability estimates:

Expansion	Stability	Contraction
0.1	0.4	0.5

What portfolio should be selected if he uses the expected monetary value criterion?

- c) If perfect information is available to the investment manager, how much should he pay for it?

Question 5

A manufacturer has spent E20, 000 on developing a product, and must now decide whether to manufacture on a small scale or a large scale. If the demand for the product is high, then the expected profit during the product's life would be E700, 000 for a high manufacturing level and E150,000 for a low manufacturing level. If demand is low, then the expected profit is E100,000 for a high manufacturing level and E200,000 for a low manufacturing level. The initial indication is a 40% chance of a high demand, but a market research survey could predict the demand with 85% accuracy. How much can the manufacturer afford to spend on market research?

END OF EXAM

TABLE 3 (continued)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869				.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049						.9117	.9162	.9177
1.4	.9192	.9207								.929
1.5	.9332	.934								.941
1.6	.9452	.946								.9515
1.7	.9554	.956								.9633
1.8	.9641	.964								.9706
1.9	.9713	.97								.9767
2.0	.9772	.97								.9817
2.1	.9821	.98								.9857
2.2	.9861	.98								.9890
2.3	.9893	.98								.9916
2.4	.9918	.99								.9936
2.5	.9938	.99								.9952
2.6	.9953	.99								.9964
2.7	.9965	.99								.9974
2.8	.9974	.99								.9981
2.9	.9981	.99								.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9990	.9992	.9995	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9995	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

ST 408

Table