UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

MAIN EXAMINATION PAPER

MAY, 2009

(*FULL TIME / IDE STUDENTS*).

TITLE OF PAPER	:	MANAGEMENT SCIENCE
COURSE CODE	:	BA 412
TIME ALLOWED	:	THREE (3) HOURS
TOTAL MARKS	:	100 MARKS
INSTRUCTIONS	:	(1) TOTAL NUMBER OF QUESTIONS IN THIS PAPER IS FIVE (5)
		(2) THE PAPER CONSISTS OF SECTION A AND SECTION B.
		(3) ANSWER ALL QUESTION IN SECTION A WHICH IS COMPULSORY AND ANY TWO (2) QUESTIONS IN SECTION B.
		(4) THE MARKS ALLOCATED FOR A QUESTION / PART OF A QUESTION ARE INDICATED AT THE END OF EACH QUESTION / PART OF QUESTION.
		(5) WHERE APPLICABLE, ALL WORKINGS / CALCULATIONS MUST BE CLEARLY SHOWN.

NOTE: MAXIMUM MARKS WILL BE AWARDED FOR GOOD QUALITY LAYOUT, ACCURACY, AND PRESENTATION OF WORK.

THIS PAPER MUST NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

SECTION A (COMPULSORY) - 50 MARKS

Q1. A certain item is produced in batches of size **Q** to meet a constant demand of **D** per year. The manufacturing cost is **EC** per item and the stockholding cost is **EH** per item per year. Each production run commences when stock falls to zero and the cost of setting up the production facilities is **ES** per run. You may assume that production takes place relatively quickly such that stock replenishment is effectively instantaneous.

Required:
(a). Write down an expression for the total annual production cost which comprises manufacturing, set-up and stockholding costs. Show that at the economic batch quantity (EBQ), the total annual set-up cost is equal to the total annual stockholding cost. (It is not necessary to derive the expression for the EBQ). (10marks).

(b). Experience has shown that the manufacturing cost accounts for about 75% of the total production cost when EBQ are used.

   (i). What percentage increase in total production cost will result if the batch size is increased by 50% from the EBQ? (8marks).

   (ii). What percentage increase in total production cost will result if the batch size is decreased by 50% from the EBQ? (7marks).

   (iii). If the batch size is doubled, there will be a saving of 5% in the manufacturing cost due to more efficient working. Show that this saving of 5% will not lead to a lower total annual production cost. How large a saving in manufacturing cost is necessary for it to be economical to double the batch size? (10marks).

Q2. A company has a fleet of vehicles and is trying to predict the annual maintenance costs per vehicle. The following data have been supplied for a sample of vehicles:

Vehicle No:	1	2	3	4	5	6	7	8	9	10
Age in years:	2	8	6	8	10	4	4	2	6	10
Maintenance cost per annum: (E x 10)	60	132	100	120	150	84	90	68	104	140

Required:

    (a). Using the least-squares technique, calculate the values of *a* and *b* in the equation $y = a + bx$, to allow managers to predict the likely maintenance cost, knowing the age of the vehicles. (6marks).

    (b). Prepare a table of maintenance costs covering vehicles from one to ten years of age, based on your calculations in *(a)*. (5marks).

    (c). Estimate the maintenance costs of a 12-year-old vehicle and comment on the validity of making such an estimate. (4marks).

SECTION B (Answer any two questions) - 50 MARKS.

Q3. A retailer has placed an order for 40 units of a product to be delivered daily. The estimated sales for each day are expected to follow the following probability distribution, to which random number digits have been allocated:

Demand	Probability
10	0.06
20	0.10
30	0.15
40	0.40
50	0.16
60	0.13

The product unit cost is E20 and is sold for E30 each and it has been estimated that if there is no stock to satisfy a particular customer, the business will suffer a *loss* of E6 for each unit of unsatisfied demand. The retailer has no storage facilities hence any unit not sold by the end of a day are thrown away.

Random number digits to be used for daily demand, starting with the first "93" are:
9353819388232296790614946735.
You are required to:

(a). Simulate 10 days' demand. (6marks).

(b). Calculate, and state, the resulting profit or loss to the business. (4marks).

(c). Calculate, and state, the effect of increasing the daily order to 50 units, still with no storage facilities. (6marks).

(d). Calculate, and state, the effect of a daily order of 50 units if there were free, unlimited storage facilities. (9marks).

Q4. The UNISWA Bookshop has identified the major activities involved in one of their projects in the preparation of their accounts. These activities along with their durations and the immediately preceding activities are as follows:

Activity:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Preceding Activity(s) :	-	-	-	-	-	E	A	C	D	B,G,H,I	J	F,K	N	L	N
Duration (wks):	2	2	3	1	4	2	1	2	1	1	3	2	1	6	1

(a). Draw a network to represent the interrelationship between the activities indicated, and insert earliest and latest event times throughout. (10marks).

(b). If the preparation of the account starts at the beginning of the first week in January, how many weeks will elapse before the final accounts can be presented? (3marks).

(c). Assuming that the end of week 13 is the end of the financial year for UNISWA and the management has indicated that the final accounts must have been approved by that time. The Bookshop Director has suggested that, to achieve this, activities A, C, and D can all be completed by end of December and also that the verification of stock levels which is represented by activity 'E', could be done in only two weeks if additional staff is available. Can the deadline be achieved from this suggestion? (Show your workings with appropriate comments). (7marks).

(d). Discuss briefly the relative advantages and disadvantages of 'activity-on-node' and 'activity-on-arrow' networks. (5marks).

Q5. A theatre has to decide how many programmes to produce for a run of performances. The production cost of the programmes is made up of a fixed cost of E200 plus E0.30 for each copy. The programmes are sold for E0.60 each, and, in addition, there is advertising revenue of E300. From previous experience, it is estimated that the audience attendance will be:

Total audience	4000	4500	5000	5500	6000
Probability	0.1	0.3	0.3	0.2	0.1

It is expected that 40% of the audience will buy the programme.

Calculate:

(a). Maximax payoff   (10marks).

(b). Minimax opportunity loss   (10marks).

(c). Expected payoff with perfect information   (5marks).

UNISWA: Faculty of Commerce; Dept. Of Business Administration. BA 412 Management Science Main Examination Paper, May 2009.