OLLSCOIL NA hEIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLAISTE NA hOLLSCOIL, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATIONS, 2006

B.E. DEGREE (ELECTRICAL)

Engineering Management
ME4001

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Time allowed: *3 hours*

Answer *five* questions.

All questions carry equal marks.

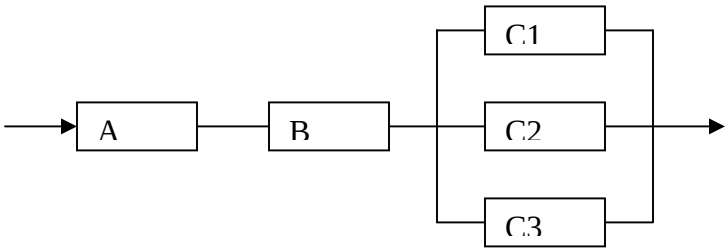
The use of a Casio fx570w or fx570ms calculator is permitted.

1. (a) Explain the terms 'reliability' , 'failure rate' and 'failure density function'. A manufacturing process under continuous operation breaks down in a random manner. The mean failure rate is one breakdown in 70 hours, which can be taken as constant. What is the reliability function and the probability density function of failure for the process? Determine the probability that the process can run for 100 hours without a breakdown. **[10 marks]**

(b) The reliabilities of components after 250 hours of operation in the system shown are: R_A =0.90, R_B = 0.85, R_{C1}=0.95, R_{C2}=0.98, and R_{C3}=0.9

The system is configured such that, in the subsystem C1-C2-C3, any two of the components have to be functional for the system to operate. Determine the reliability of the system.

If it is assumed that the failure rate for the system is constant at that time, determine the MTBF of the system.



[10 marks]

2. (a) Briefly explain the terms: Producers' risk, Consumers' risk and 'Thorndike chart'. Explain as to how the Operating Characteristic Curve, in acceptance sampling can be constructed using the Binomial distribution. **[7marks]**

(b) Explain the use of allowable drift in control charts and its consequences.

The following data was obtained when sampling was carried out on the output from a production process.

Sample no.	1	2	3	4	5	6	
Sample size	50	48	52	53	51	50	
No. of defects found	1	0	1	2	1	2	

Plot the data on the control chart & comment on the results. **[7 marks]**

c) An item has a specification of 250 ± 10 ohms and is manufactured through an automatic process without any drift. During production, sampling was carried out using a sample size of 6. This yielded a sample mean of 255 ohms and a mean range of 10 ohms. Estimate the number of items that will not meet the specification in a batch of 10,000.

[6 marks]

3. Describe briefly the differences and the areas of application of statistical inventory management and MRP systems. **[4 marks]**

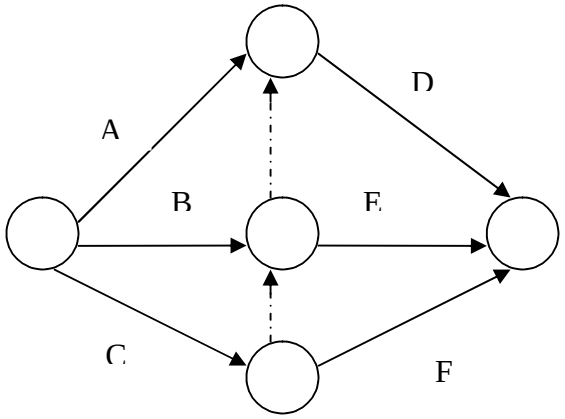
A firm manufactures a component at a rate of 15,000 per week, which is consumed in the assembly process at a rate of 1000 per week. The cost of manufacture of an item is €2.00 while the setup costs are €500.00. The items are manufactured in batches, which are multiples of 3000 items. The manufacturing lead time is 4weeks with a std. deviation of 1 week.

The same component can be bought for € 2.50 each with a ordering cost of €70.00 per batch. The purchase lead time is 3 weeks with a std. deviation of 1 week. The order quantity has to be in multiples of 5000 items.
In both cases a safety stock is maintained to give a service level of 99%. The cost of holding stock is 26% per year of the cost of the item.
Determine the economic order quantities and the reorder levels for the two situations.
Determine whether the item is to manufactured or purchased based on the cost considerations.
Derive the formulae used in the EOQ calculations. (State clearly any assumption made).

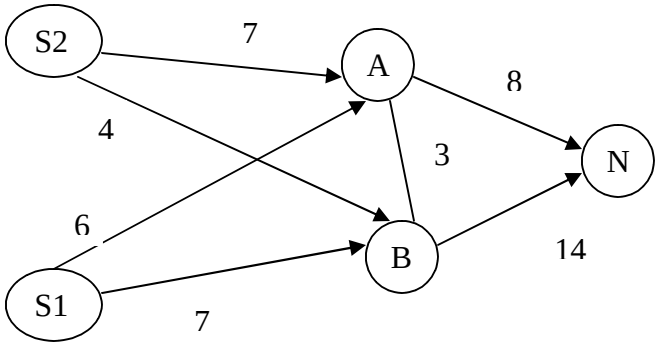
[16 marks]

4. a) For the network shown, determine the following:
the "early start", "late finish" , the total float for each of the activities,
the critical path/paths and the probability of completing the project 2 days ahead of schedule **[10 marks]**

activity	Mean Expected Duration (days)	Standard Deviation (days)	
A	4	1	
B	7	2	
C	12	2.5	
D	5	1	
E	10	2	
F	10	3	



b) What is a 'Flow Augmenting path' in a maximal flow problem.
In the network shown, the capacities of the arcs are as indicated. The sources S1 and S2 have capacities of 10 and 14 respectively. Determine, using the 'Maximal flow algorithm', the flow in each arc when the maximum flow takes place through the network. Indicate the Flow augmenting paths used. **[10 marks]**



5. a) An investment of €500,000 on equipment is expected to give a cost reduction of €100,000 per year. The equipment has a life of 10 years, but it is projected to be discontinued after 4 years and sold for €200,000.
Determine whether the investment meets a 15% yield criterion after tax , which is at 25%, under the following conditions.
i) A government grant of 25% of the capital cost in the year of investment.
ii) Depreciation to be 'straight line' to zero book value over10 years.
iii) The depreciation charge for the year to be treated as the capital allowance.
[10 marks]

b) A component can be manufactured on two different types of machines. Determine the combination of machines that has to be used to minimise costs, when the demand is 1500 items per day. Sketch the BE chart for the situation.

	M/C 1	M/C2
Fixed costs per day	€100	€200
Variable costs per item	€1.50	€1.35
Capacity of machine	750 items/day	1000 items/day

[10 marks]

6.

(a) Describe briefly the factors that have to considered before establishing a time standard for a task **[10 marks]**

b) Explain briefly the application of 'Value Analysis' to products. **[10 marks]**

7. A company manufactures two products X and Y by blending three different types of feedstock A, B and C. There are two different blending processes which yield both the products, X & Y, but in different quantities. The blending quantities and the output from the two processes per production run are shown in the table. The table also shows the quantities of feedstock available and the minimum quantities that have to be produced. The profit per 1000kg of X &Y are €600 & €900 respectively. Formulate the LP model and determine by graphical means the number of runs required from each process to maximize profit and the profits made.

	INPUT Feedstock (in 1000 kg)			OUTPUT Products (in 1000 kg)	
	A	B	C	X	Y
Process 1	5	7	5	9	7
Process 2	3	9	4	5	9
Total available	1500	1900	1000		
Minimum Production				500	300

[20 marks]