OLLSCOIL NA h-EIREANN CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND CORK

COLAISTE NA h-OLLSCOILE CORCAIGH
UNIVERSITY COLLEGE CORK

SUMMER 2000

B.E. DEGREE ELECTRICAL ENGINEERING

PRODUCTION MANAGEMENT (ME4001)

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Attempt FIVE questions
The use of approved calculators is permitted.

3 hours

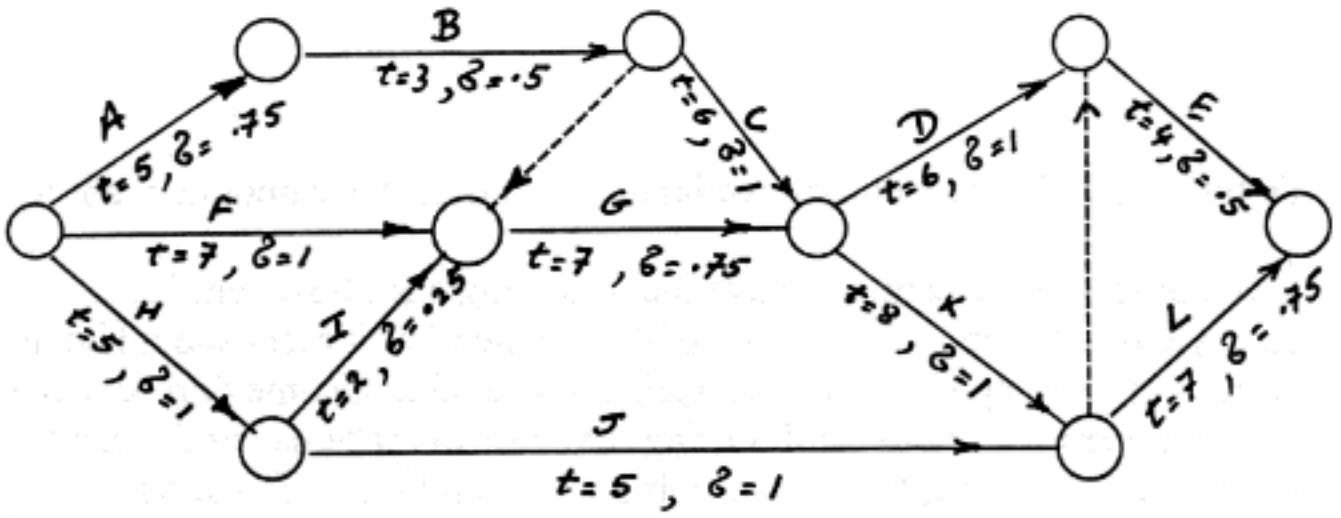
1. Describe briefly the methods available to evaluate the economic viability of investments.

Two competing investments have the following cash flow schedules. Determine using a 15% yield criterion and a tax rate of 40% which investment should be undertaken. Assume 100% capital allowance against the taxable income during the year of investment and that there is enough profit during that year to make use of the capital allowance. Assume also that the decommissioning costs can be set off against the profits.

	Investment I	Investment II
Capital expenditure	£100,000	£150,000
Life of m/c	10 years	10 years
Estimated salvage value of the end of the life of the m/c	£10,000	£10,000
Decommissioning costs	£5,000	£20,000
Net income per year	£25,000	£30,000

2. Explain briefly the use of CPM and PERT methods, indicating where these methods may be applied.

Find the critical path of the following network and determine the probability of finishing the project two weeks ahead of schedule. Indicate the early start, late finish dates and the total float for each activity. (The time duration of each activity and the standard deviations in weeks are given in diagram). If it is required to shorten the project by 4 weeks, which of the activities should be shortened and give the reasons.



3. Describe briefly the techniques used in statistical quality control.

In the manufacturing process of an electrical component one of the critical values is its resistance which is monitored under statistical quality control. Due to the nature of the process the value of the resistance tend to increase with the number of components produced at the rate of 1Ω per 10,000 components.

On taking 10 samples of 5 each, the values obtained were 1001Ω as the mean with a mean sample range of 3Ω. If the design tolerance is $1000\pm6\Omega$, draw the control charts for the process and comment on the process capability and the initial setting required for an optimum production run, giving the production quantity between resets.

Explain the consequence of using the "allowable drift" to decrease the number of resets.

4. The components X and Y are manufactured using 3 machines A, B and C. The processing time (in minutes) for each component on each machine is given in the table.

The profit from each component X and Y are £10 and £15 respectively.

Machines / Component	A	B	C
X	2	1	3
Y	1	2	1

Determine the maximum profit that can be generated during a 40 hour week and the unused capacities on the machines.

5. Discuss briefly the different types of layout of facilities in a factory giving the advantage/disadvantage of each type and the situations where each should be used.

Describe also the FMS approach in modern factories.

6. Describe briefly the components of lead times in Inventory and Manufacturing situations.

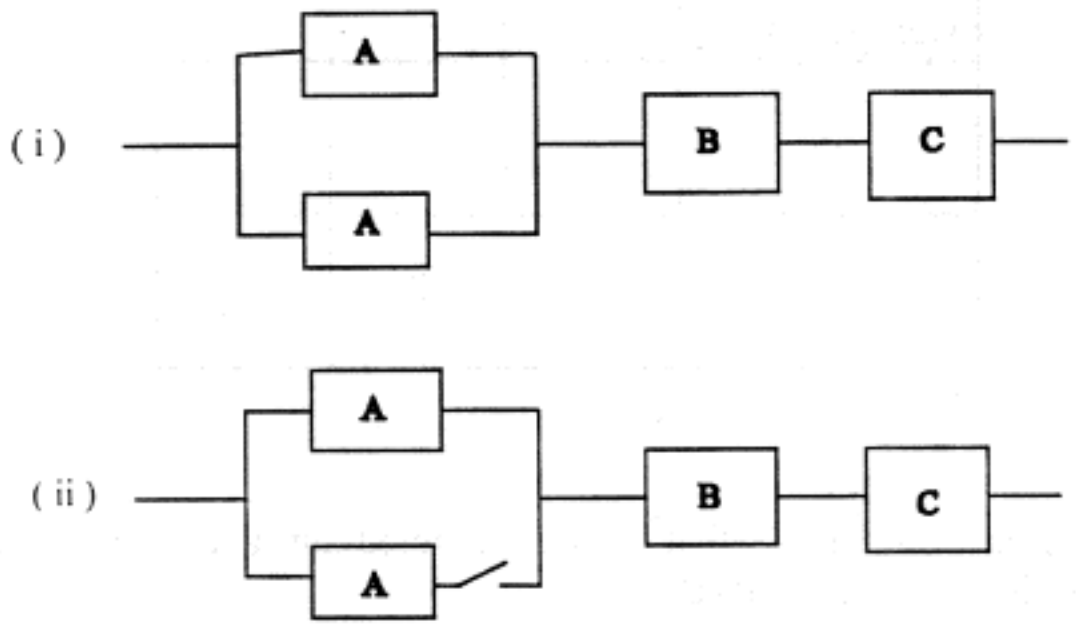
A firm manufacturers a component which is consumed in the plant. The demand for the component is variable with a mean of 1,000 per week and a standard deviation of 250. The production rate can be taken to be constant at 10,000 per week. Determine the optimum batch size to be produced.

Determine also the re-order level and the safety stock to be maintained to give a service level of 99%. Assume that the order to manufacture is issued when the stock level falls to its re-order level and that a time of 3 weeks is required between the issue of order and the start of the production.

Manufactured cost of item = £15.00
Holding costs = 26% per year of the 1st cost
Set up costs = £700.00

Determine the production range, if the variable costs (holding and set up costs) is allowed to vary by 10% of its minimum value. Prove any formulae you may use.

7. Describe briefly a typical failure rate curve for a batch of components.



In the systems shown above, the component A can be built in as a redundant component or as a stand-by component as indicated in (i) and (ii) respectively. The reliability of the components is described by

$$R_i(t) = e^{-\lambda_i t}$$

where

$$\lambda_A = 0.1 \text{ per } 2000 \text{ hrs}$$
$$\lambda_B = \lambda_c = 0.15 \text{ per } 2000 \text{ hrs}$$

Determine the reliability of the two systems after 1000 hrs of operation and the MTBF of system (i).

Assume that the reliability of the component A in the stand-by mode is given by

$$(1+\lambda_A t)\, e^{-\lambda_A t}$$

Also determine the "Average Production Factor" after 1000 hrs of operation in system (i) when the capacity of component A is 75% of the total load.