

**This paper is not to be removed from the Examination Halls**

**UNIVERSITY OF LONDON**

**279 0035 ZA**

**BSc degrees and Diplomas for Graduates in Economics, Management, Finance and the Social Sciences, the Diploma in Economics and Access Route for Students in the External Programme**

**Production and Operations Management**

Friday, 26 May 2006 : 2.30pm to 5.30pm

Candidates should answer **FIVE** of the following **SIX** questions: **TWO** from Section A and **THREE** from Section B. All questions carry equal marks.

Graph paper is provided. If used, it must be fastened securely inside the answer book.

Workings should be submitted for all questions requiring calculations.

A hand held calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics, text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

PLEASE TURN OVER



## SECTION A

Answer **both** questions from this section.

1. Assume that you are the Production Manager of a small workshop. You have the authority to allow an increase of 0.5% in the inventory control costs (when compared to the minimum possible) for each product or part you keep in the stores. The inventory control costs are defined as the sum of the cost of ordering and the cost of inventory holding. For a particular part Z, the present order quantity is 800 units. A safety stock of 200 units is to be held to allow variations in the supply pattern. The ordering costs are £200 and the annual interest rate used by the company is 15% per year. The current price paid for the part is £22.50 per unit. The current usage is 4800 units per year.

You have been informed by the purchase department that the price per unit is to be increased to £23.50 and the accounting department has informed you that the interest rate has been reduced to 10% per year. You have considered the above two pieces of information and have decided that the order quantity of 800 units should be maintained even after the changes in the unit price and interest rate. You are more flexible with the safety stock level.

### **Required:**

- (a) What are the Economic Order Quantity and the annual inventory cost now?
  - (b) Are you within your managerial authority to maintain the present policy of ordering 800 units and maintaining 200 units of safety stock, before and after the changes mentioned for price per unit and the interest rate?
  - (c) If the answer to either part of (b) above is no, what action, if any, can you take to keep the costs within the authority?
2. (a) What do you understand by the term 'productivity' and how can this be improved in an organisation?
  - (b) What do you understand by the term 'zero defects' as advocated by Philip Crosby in the context of Quality Management?
  - (c) Describe briefly what is meant by 'product layout' and state what you consider to be the main advantage and disadvantage of such a layout.
  - (d) In the context of Inventory Control, the term 'safety stock' has been used. Why do you need safety stock and what factors, in your view, should influence the determination of the level of safety stock held?

## SECTION B

Answer **three** questions from this section.

3. A company has to decide which of the three types of machine it should buy to produce a part that is estimated to have an annual demand of 30,000 units. All machines have a life span of 6 years after which they have to be sold as scrap. The company uses an interest rate of 10% per year in all its calculations. The relevant data are:

	<b>machine X</b>	<b>machine Y</b>	<b>machine Z</b>
Purchase Price per machine	£35,000	£55,000	£100,000
Production capacity of each Machine in units per year	10,000	15,000	30,000
Service costs per machine per year	£7,000	£14,000	£18,000
Scrap Value per machine	£1,000	£1,500	£3,000

**Required:**

Which machine type would you recommend the company to buy and why?

4. The operations time and the precedence restrictions involved in an assembly line are shown as follows:

Operations	Operation time in minutes	Immediate predecessor operation(s)
A	4.5	None
B	7.0	A
C	5.0	A
D	1.0	A
E	4.5	None
F	3.0	B, C, D and E
G	1.5	A
H	3.0	A
I	2.0	G
J	2.5	F
K	1.0	H
L	2.0	None
M	3.0	J

**Required:**

- Draw the network, using the activity on the arrow system, of the operations.
  - Determine the earliest and latest start time for each node.
  - Determine the critical path and the duration.
  - If two operators are assigned for each assembly line, determine how they could share the workload between them.
  - You may assume for this part of the question that any number of operators can be assigned to the assembly line. Equally, any number of assembly lines can be built. If exactly six units of the assembly are required per hour, how many assembly lines would you have and on each line, how many operators would you assign? What assumptions have you made, if any, in arriving at the answers you have given?
5. A company uses control charts in the quality control department. Describe briefly the various types of control charts, their characteristics, how they could be applied and their usefulness to the company.

6. A cement manufacturing company makes two types of cement, namely, powder cement and cement granules. The four processes involved that both types of cement undergo are:

- Crushing - a crushing process where the raw material that is in the form of large rock is crushed and mixed with water to form slurry.
- Burning - burning the slurry in the kilns to form clinker.
- Milling - milling the clinker, either to form powder or granules, depending upon the mill involved.
- Packing - packing the cement in plastic lined bags and sealing them.

The available capacities next week are 360, 360, 360 and 324 hours for crushing, burning, milling and packing respectively. The times taken per bag of powder cement in the four processes are 0.125, 0.12, 0.1125 and 0.09 hours respectively. Similarly, a bag of granule cement would take 0.09, 0.12, 0.15 and 0.162 hours respectively. The present profit for a bag of powder cement is £2.80 and for a bag of granule cement is £3.20. The Company can sell all of its weekly production.

A large Construction Company has offered to buy all of next week's production and has given you two choices with respect to the profit per bag you will obtain:

1. £3.00 profit for powder cement and £2.80 for granule cement.
2. £2.60 profit for powder cement and £3.60 for granule cement.

**Required:**

- (a) Formulate the original problem before the offer from the large construction company, as a Linear Programme.
- (b) And hence determine the number of bags of powder and granule cement you would produce in order to maximise the profit. What is the maximum profit you can get?
- (c) Which, if any, of the two offers from the large construction company would you choose? What are the production quantities in this case? How much change, if any, would there be in the profit?

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