

# **UNIVERSITY OF LONDON**

**B.Sc., B.Eng. and M.Eng. Examination 1999**

**Parts III and IV**

**For internal students of Imperial College of Science, Technology and Medicine.**

This paper also forms part of the examination for the Associateship.

## **PROJECT MANAGEMENT**

**For Chemical Engineering, Electrical Engineering and Mechanical Engineering Students.**

Wednesday 5<sup>th</sup> May 1999, 14:30 - 16:00

**Closed Book**

ANSWER **QUESTION 1** (40%) AND  
ANY **TWO** OTHER QUESTIONS (30% EACH)

### **Question 1 (40%)**

A project is specified by the following activities:

Activity	Immediate Predecessor(s)	Duration (days)
<b>A</b>	-	11
<b>B</b>	<b>A</b>	9
<b>C</b>	<b>A, B</b>	11
<b>D</b>	<b>A</b>	19
<b>E</b>	<b>B</b>	7
<b>F</b>	<b>C, D, E</b>	15
<b>G</b>	<b>E, F</b>	4

- (a) Construct an activity on node network to represent the above project. (6%)
- (b) Calculate the earliest start (ES), latest start (LS), earliest finish (EF) and latest finish (LF) times for each activity.
- Also calculate the minimum project completion time and identify the critical path. (9%)
- (c) What is the total float associated with each of the non-critical activities? (4%)
- (d) In your answer to part (b), what effect, if any, will each of the following changes have on the completion time of the project :
- (i) Activity D is delayed by 3 days;
  - (ii) Activity C is finished 1 day early.
- (4%)
- (e) In the network of part (a), suppose that activity F cannot start until at least 2 days after activity D is finished.
- How is the project duration and critical path affected as a result of including this dependency in the project ? (5%)
- (f) Discuss how each of the following parameters influence your choice for a project organisational structure ?
- (i) The project cost.
  - (ii) The project schedule.
  - (iii) The project duration.
  - (iv) The technology requirements.
  - (v) The geographical locations.
  - (vi) The required working relationships with the client.
- (12%)

**Question 2 (30%)**

Consider the following project (all times are in days).

Activity	Immediate Predecessor(s)	Optimistic Time (a)	Most Likely Time (m)	Pessimistic Time (b)
<b>A</b>	-	1	2	3
<b>B</b>	-	2	3	4
<b>C</b>	-	1	3	5
<b>D</b>	<b>A</b>	1	2	3
<b>E</b>	<b>B</b>	1	1	1
<b>F</b>	<b>B</b>	1	2	3
<b>G</b>	<b>B</b>	2	3	4
<b>H</b>	<b>C</b>	3	5	7
<b>I</b>	<b>C</b>	1	3	5
<b>J</b>	<b>A</b>	2	3	4
<b>K</b>	<b>D, E</b>	2	3	4
<b>L</b>	<b>F, K</b>	2	4	6
<b>M</b>	<b>G, H</b>	3	4	5
<b>N</b>	<b>I</b>	1	3	5
<b>O</b>	<b>J, L, M, N</b>	1	2	3

- (a) Construct an activity on arrow network for the above project.

(6%)

- (b) Determine the minimum expected completion time of the project and its variance.

Identify the critical path.

Mean duration ( $t_e$ ) and standard deviation ( $\sigma_t$ ) of an activity are given by:

$$t_e = (a + 4m + b) / 6$$

$$\sigma_t = (b - a) / 3.2$$

(8%)

- (c) Calculate the probability that the project can be completed within 17 days or less.

(4%)

- (d) Determine the range of expected time required to ensure a 95 percent chance of project completion limits.

(6%)

- (e) Explain how career paths and career growth can differ between project-driven and non-project driven organisations.

(6%)

### **Question 3 (30%)**

(a) The project activities of Question 1 require the use of a resource Y as follows:

Activity	Immediate Predecessor (s)	Duration (days)	Units of Resource Y Required per Day
<b>A</b>	-	11	5
<b>B</b>	<b>A</b>	9	4
<b>C</b>	<b>A, B</b>	11	4
<b>D</b>	<b>A</b>	19	2
<b>E</b>	<b>B</b>	7	10
<b>F</b>	<b>C, D, E</b>	15	8
<b>G</b>	<b>E, F</b>	4	2

Using your answer to parts (a) and (b) of Question 1, calculate the daily requirements of resource Y over the period of project completion for both an early-start (ES) and a late-start (LS) schedule.

What is the average daily requirement for resource Y ?

Define the Criticality Index for this resource and explain how it can be used in project scheduling.

(14%)

(b) You have been asked to develop a Work Breakdown Structure (WBS) for introducing a new product into the marketplace.

Briefly discuss how, using this WBS, you can plan and control your project.

(6%)

(c) Under what conditions a lump sum fixed price contract is the preferred option for a project over a cost reimbursable type of contract ?

Compare the advantages and disadvantages of the two types of contracts.

(10%)

**Question 4 (30%)**

You are the client on a project which involves the design and development of a new high-technology product.

- (a) Briefly identify the objectives and the main life-cycle phases of the above project.

(7%)

- (b) At what phase in the life-cycle of the project should you appoint a project manager ?

Describe his/ her main responsibilities throughout the project.

(9%)

- (c) What possible difficulties is the project manager likely to encounter in his/ her role and how could these be overcome ?

(7%)

- (d) One of the major controversies in project management occurs over whether the project manager needs a command of technology in order to be effective.

Comment on the above statement.

Briefly outline the main attributes of the successful project manager.

(7%)