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 5th 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)
A	**-**	11
B	**A**	9
C	**A, B**	11
D	**A**	19
E	**B**	7
F	**C, D, E**	15
G	**E, F**	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)
A	**-**	1	2	3
B	**-**	2	3	4
C	**-**	1	3	5
D	**A**	1	2	3
E	**B**	1	1	1
F	**B**	1	2	3
G	**B**	2	3	4
H	**C**	3	5	7
I	**C**	1	3	5
J	**A**	2	3	4
K	**D, E**	2	3	4
L	**F, K**	2	4	6
M	**G, H**	3	4	5
N	**I**	1	3	5
O	**J, L, M, N**	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 (σ_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
A	**-**	11	5
B	**A**	9	4
C	**A, B**	11	4
D	**A**	19	2
E	**B**	7	10
F	**C, D, E**	15	8
G	**E, F**	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%)