UNIVERSITY OF LONDON

B.Sc., B.Eng. and M.Eng. Examination 2001

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, Information Systems Engineering and Aeronautical Engineering Students.

Wednesday 9 May 2001, 14:30 - 16:00

Closed Book

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

If more than three questions are answered only question one and the first two other questions answered will be marked

Marks will be deducted in this examination if there is insufficient written explanation

Question 1 (40%)

A project is specified by the following activities:

Activity	Preceding Activities	Duration (days)
A	-	3
B	-	4
C	-	4
D	A	4
E	A	4
F	B	2
G	B	3
H	B	4
I	C	6
J	C	4
K	D, F	4
L	G, K	5
M	H, I	5
N	J	4
O	E, L, M, N	3

(a) Draw an activity on node network to represent the above project. (9 marks)

(b) Calculate the earliest start (ES), latest start (LS), earliest finish (EF) and latest finish (LF) times for each activity. (6 marks)

(c) Explain the term *total float*. Calculate the total float for each activity. (5 marks)

(d) Determine the critical path(s) and interpret its meaning. What is the minimum project completion time? (5 marks)

(e) What effect will each of the following changes (when considered separately) have on the critical path(s) and the completion time of the overall project? Give reasons for your answer.

I. Activity D is delayed by 2 days.

II. Activity G is completed in 8 days. (4 marks)

(f) Clearly show how the project network you have drawn in (a) above needs to be amended to represent the logical constraint that activity O cannot start until at least 4 days after activity M has finished. How are the overall project completion time and critical path(s) affected if this condition is imposed. (5 marks)

(g) Briefly explain the use of schedule risk analysis in project planning. (6 marks)

Question 2 (30%)

An aerospace company has received a contract from NASA for the final assembly of a space module for an upcoming mission. A team of engineers has determined the activities, precedence constraints and time estimates as given in the table below.

Activity	Preceding Activities	Optimistic time (days)	Most likely time (days)	Pessimistic time (days)
A	-	5	11	11
B	-	10	10	10
C	-	2	5	8
D	A	1	7	13
E	B	4	4	10
F	B	4	7	10
G	B	2	2	2
H	C	0	6	6
I	D, E	1	4	7
J	G, H	2	8	14

(a) Draw an activity on arc network to represent this project. (6 marks)

(b) Determine the critical path(s). What is the expected project completion time and its variance?

Mean duration (t_e) and standard deviation (σ_t) of an activity are given as follows:

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

$$\sigma_t = (b-a)/6$$

a: optimistic time
b: pessimistic time
m: most likely time (7 marks)

(c) What is meant by the terms *free float* and *independent float*. Calculate the *free float* and *independent float* for each activity. (4 marks)

(d) By making use of the N(0,1) tables provided calculate:

I. The probability that the project will be completed by 17 days.

II. By what date is management 90 percent sure completion will occur?

(6 marks)

(e) If the company can complete the project within 18 days it will receive a bonus of £10000. But if the project delays beyond 22 days it must pay a penalty of £5000. If the firm can choose whether or not to bid on this project, what should its decision be if the project is only a breakeven one? (*hint:* compute the expected value of the project). (7 marks)

Question 3 (30%)

(a) The project network for shooting a TV commercial as shown below has a fixed cost of £85 per day, but money can be saved by shortening the project duration.

Activity	Preceding activities	Normal Time (days)	Crash Time (days)	Cost Increase (£) (1^{st}, 2^{nd}, 3^{rd} day)
A	-	7	4	25, 45, 65
B	-	12	10	55, 55
C	A	9	6	35, 40, 60
D	A	11	9	30, 55
E	B, C	3	3	-

I. Draw either an activity on arrow network or an activity on node network to represent the above project.

II. Using normal times calculate the minimum project completion time and determine the critical path (s).

III. Which activities should be crashed to obtain the *least cost* schedule? Find the cost of this schedule. (14 marks)

(a) Analyse the key factors affecting the success of a project as a function of the project's life cycle. In each phase of the life cycle which factor is more important and why? (9 marks)

(b) Identify the benefits and disadvantages for a Project Manager of using a computerised system (project management software) over a manual one. (7 marks)

Question 4 (30%)

(a) "Compared to a functional manager, a Project Manager is a *generalist* rather than a specialist, a *synthesiser* rather than an analyst and a *facilitator* rather than a supervisor." Discuss this statement. (15 marks)

(b) What is a matrix organisation and why is it often appropriate for the governance of a project? What attributes do you believe are desirable in an engineering specialist managing a project in a matrix organisation? (15 marks)

Illustrate your answers to *all* parts of this question either through your own experience or using specific examples discussed on the course.

N(0.1) values

	0.00	*0.01*	*0.02*	*0.03*	*0.04*	*0.05*	*0.06*	*0.07*	*0.08*	*0.09*
0.0	0.500	0.504	0.508	0.512	0.516	0.520	0.524	0.528	0.532	0.536
0.1	0.540	0.544	0.548	0.552	0.556	0.560	0.564	0.567	0.571	0.575
0.2	0.579	0.583	0.587	0.591	0.595	0.599	0.603	0.606	0.610	0.614
0.3	0.618	0.622	0.626	0.629	0.633	0.637	0.641	0.644	0.648	0.652
0.4	0.655	0.659	0.663	0.666	0.670	0.674	0.677	0.681	0.684	0.688
0.5	0.691	0.695	0.698	0.702	0.705	0.709	0.712	0.716	0.719	0.722
0.6	0.726	0.729	0.732	0.736	0.739	0.742	0.745	0.749	0.752	0.755
0.7	0.758	0.761	0.764	0.767	0.770	0.773	0.776	0.779	0.782	0.785
0.8	0.788	0.791	0.794	0.797	0.800	0.802	0.805	0.808	0.811	0.813
0.9	0.816	0.819	0.821	0.824	0.826	0.829	0.831	0.834	0.836	0.839
1.0	0.841	0.844	0.846	0.848	0.851	0.853	0.855	0.858	0.860	0.862
1.1	0.864	0.867	0.869	0.871	0.873	0.875	0.877	0.879	0.881	0.883
1.2	0.885	0.887	0.889	0.891	0.893	0.894	0.896	0.898	0.900	0.901
1.3	0.903	0.905	0.907	0.908	0.910	0.911	0.913	0.915	0.916	0.918
1.4	0.919	0.921	0.922	0.924	0.925	0.926	0.928	0.929	0.931	0.932
1.5	0.933	0.934	0.936	0.937	0.938	0.939	0.941	0.942	0.943	0.944
1.6	0.945	0.946	0.947	0.948	0.949	0.951	0.952	0.953	0.954	0.954
1.7	0.955	0.956	0.957	0.958	0.959	0.960	0.961	0.962	0.962	0.963
1.8	0.964	0.965	0.966	0.966	0.967	0.968	0.969	0.969	0.970	0.971
1.9	0.971	0.972	0.973	0.973	0.974	0.974	0.975	0.976	0.976	0.977
2.0	0.977	0.978	0.978	0.979	0.979	0.980	0.980	0.981	0.981	0.982
2.1	0.982	0.983	0.983	0.983	0.984	0.984	0.985	0.985	0.985	0.986
2.2	0.986	0.986	0.987	0.987	0.987	0.988	0.988	0.988	0.989	0.989
2.3	0.989	0.990	0.990	0.990	0.990	0.991	0.991	0.991	0.991	0.992
2.4	0.992	0.992	0.992	0.992	0.993	0.993	0.993	0.993	0.993	0.994
2.5	0.994	0.994	0.994	0.994	0.994	0.995	0.995	0.995	0.995	0.995
2.6	0.995	0.995	0.996	0.996	0.996	0.996	0.996	0.996	0.996	0.996
2.7	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997
2.8	0.997	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998
2.9	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.999	0.999	0.999
3.0	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
3.1	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
3.2	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
3.3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
3.4	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
3.5	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000