UNIVERSITY OF BOLTON

SCHOOL OF ENGINEERING

MSc CIVIL ENGINEERING

MSc CONSTRUCTION PROJECT MANAGEMENT

SEMESTER ONE EXAMINATIONS 2024/2025

PROJECT MANAGEMENT

MODULE NO: CPM7002

Date: Thursday 9th January 2025 **Time: 10:00 – 13:00 hrs**

INSTRUCTIONS TO CANDIDATES:

This assessment contains two sections: section 'A' and section 'B'

Section A contains TWO questions: YOU MUST ANSWER THESE TWO QUESTIONS. They are worth a total of 50 marks.

Section B contains THREE questions: you should answer ANY TWO questions from these three questions. Each of these questions is worth 25 marks.

Marks for parts of questions are shown in brackets.

This assessment carries 100 marks.

All working must be shown.

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester 1 Examinations 2024/2025
Project Management
Module No: CPM7002

Section A – Compulsory Questions

Question One

Table Q1 contains 14 construction activities and their duration (in **days**) in a project. The table also shows the immediate predecessor for each activity (s).

Table Q1

Activity	Duration	Preceded By
A	2	–
B	7	A
C	10	A
D	4	A
E	6	B
F	5	B, C
G	8	C, D
H	9	D
I	12	F, G
J	5	F
K	5	E, J
L	6	G, H
M	4	F, H
N	3	I, K, L, M

Complete the following tasks:

(a) Draw a network diagram for the above activities using a Precedence Diagram.
(8 marks)

(b) Carry out forward and backward passes to determine earliest & latest start times and earliest & latest finish times for each activity, the network critical path and the project duration.
(8 marks)

(c) Calculate the Total Float (TF), and Free Float (FF) for all non-critical activities.
(8 marks)

(d) The construction manager came to know that due to some labour commitments, which are outside his hands, there will be a delay of 4 days in activity H and of 5 days in activity M. Explain how this would affect the network critical path and the total duration of the project.
(6 marks)
[Total 30 marks]
PLEASE TURN THE PAGE

Question Two

(a) PRINCE2 methodology involves six variables to control project performance. Discuss these variables and justify their choice.
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(6 marks)

(b) Within the context of PRINCE2, explain what are meant by Principles, Themes and Processes and the concept of tailoring in managing a project and show how they fit in the PRINCE2 structure.

(7 marks)

(c) Appraise the roles and responsibilities of a project manager, and critically discuss the skills and attributes required to be an effective project manager.
(7 marks)

[**Total 20 marks**]

END OF SECTION A

PLEASE TURN THE PAGE FOR SECTION B

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester 1 Examinations 2024/2025
Project Management
Module No: CPM7002

Section B – ANSWER ANY TWO QUESTIONS

Question Three

The activities involved in the construction of a road project are given in **Table Q3.1** together with their estimated durations, logical sequence and cost. Each of the activities will be done using a separate gang. At the end of day 10 from start of the project, the actual work status report is shown in **Table Q3.2**.

For this project, complete the following tasks:

(a) Draw the project Bar Chart as a planning or programming tool

(6 marks)

(b) Develop the project Baseline Budget curve (S-Curve)

(6 marks)

(c) Use the Earned Value Management (EVM) technique, check whether the project is on track cost wise and schedule wise.

(13 marks)
[Total 25 marks]

Table Q3.1

Activity	Predecessor	Duration (Day)	Cost/Day (£/Day)	Total Cost (£)
A	–	6	300	1800
B	–	2	350	700
C	A	8	450	3600
D	A, B	5	250	1250
E	B	3	400	1200
F	D, E	6	300	1800

Table Q3.2

Activity	Actual % Complete	Actual Cost (£)
A	100	2000
B	100	1000
C	30	1800
D	80	1300
E	100	1350
F	0	0

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Question Four

(a) Critically discuss the six main steps of value engineering, and the main tasks and outcomes of each stage.

(12 marks)

(b) Critically evaluate the process of Project Risk Management and how each stage of risk analysis and risk response could be conducted including the techniques/tools used in each stage.

(**13 marks)**

[Total 25 marks]

PLEASE TURN THE PAGE

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester 1 Examinations 2024/2025
Project Management
Module No: CPM7002

Question Five

A Construction company is considering placing a bid on a building project. One of the company construction planners has determined that five activities would need to be performed to carry out the project. Using the **PERT** three-estimate approach, the planner has obtained the time estimates in **Table Q5** for how long these activities will take. Also shown are the precedence relationships for these activities.

Activity	Estimated Times (Weeks)			Preceded by
	a **(Optimistic)**	***m*** **(Most Likely)**	***b*** **(Pessimistic)**	
A	**3**	**4**	**5**	**-**
B	**2**	**2**	**2**	**A**
C	**3**	**5**	**6**	**B**
D	**1**	**3**	**5**	**A**
E	**2**	**3**	**5**	**B, D**

Table Q5

There is a financial penalty if the project is not completed in 11 weeks. Therefore, the planner is very interested in how likely it is that his company could finish the project in time. Based on the above information perform the following tasks:

(a) Construct the network of this project.

(5 marks)

(b) Find the estimate of the mean and variance of the duration for each activity.

(8 marks)

(c) Find the mean critical path.

(5 marks)

(d) Find the approximate probability of completing the project within 11 weeks.

(7 marks)

[Total 25 marks]

END OF QUESTIONS

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Useful Formulae

PERT Equations

$$t_e = \frac{a + 4m + b}{6} \quad ; \quad v_e = \left(\frac{b - a}{6}\right)^2$$

$$T = \sum_{i=1}^{n} t_e^i \quad ; \quad S = \sqrt{\sum_{i}^{n} v_e^i}$$

$$Z = \frac{d - T}{S} \quad ; \quad P(d \leq T) = 1 - P(T > d)$$

where,

t_e	= expected mean duration of activity
v_e	= variance of activity duration
a	= optimistic estimate for activity duration
m	= most likely estimate for activity duration
b	= pessimistic estimate for activity duration, ($a < m < b$)
T	= project mean duration
S	= standard deviation of project duration
d	= project required deadline duration
n	= number of activities along the critical path
$P(d \leq T)$	= probability of project required duration less than or equal project expected duration
Z	= standard normal random variable

PLEASE TURN THE PAGE

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester 1 Examinations 2024/2025
Project Management
Module No: CPM7002

EVM Terms and Equations

EVM Term		Definition	Formula
Planned Value*	**PV**	The budgeted cost for the work scheduled.	
Earned Value*	**EV**	The budgeted cost for the work actually completed.	
Actual Cost*	**AC**	The actual cost of the work actually completed.	
Schedule Variance	**SV**	The measure of schedule performance on a project.	**SV = EV – PV**
Cost Variance	**CV**	The measure of cost performance on a project.	**CV = EV – AC**
Schedule Performance Index	**SPI**	The measure of progress achieved compared to progress planned.	**SPI = EV / PV**
Cost Performance Index	**CPI**	The measure of the value of work completed compared to the actual cost or progress.	**CPI = EV / AC**

PLEASE TURN THE PAGE

School of Engineering
MSc Civil Engineering & Construction Project Management
Semester 1 Examinations 2024/2025
Project Management
Module No: CPM7002

Standard Normal Probabilities

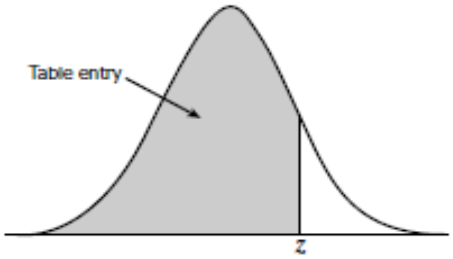

Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

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