ENG156

UNIVERSITY OF GREATER MANCHESTER

SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT

MSc CIVIL ENGINEERING &

MSc CONSTRUCTION PROJECT MANAGEMENT

SEMESTER ONE EXAMINATION 2025/2026

PROJECT MANAGEMENT

MODULE NO: CPM7002

Date: Wednesday 14th January 2026 **Time: 10:00am – 1:00pm**

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.

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Section A – Compulsory Questions

Question One

a) Critically discuss the meaning of Principles, Themes, and Processes in project management within the framework of PRINCE2 and demonstrate how they relate to the framework.

(5 marks)

b) Project management with PRINCE2 involves regulating the performance of six variables. Critically discuss these variables and explain why they were chosen.

(5 marks)

c) Critically evaluate the roles and duties of a project manager and critically discuss the skills and attributes required to be an effective project manager.

(5 marks)

d) Critically discuss the five key stages through which groups or teams pass (Tuckman's Model) and relate that to the nature of the construction industry.

(5 marks)
[Total 20 marks]

Question Two

Table Q2 contains 12 construction activities and their duration (in **weeks**) in a project. The table also shows the immediate predecessor for each activity (s) as well as the leading and lagging time of some activities (**in weeks**) from a specific predecessor.

(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), Free Float (FF) and Total Time Available (TTA) for all non-critical activities.

(6 marks)

(d) The construction manager discovered that duration of activity F should be 15 weeks instead of 5 weeks; and that activity L follows J (as before) but should begin 8 weeks after the completion of C & not 2 weeks. Explain how this would affect the network critical path and the total duration of the project.

(8 marks)
[**Total 30 marks**]

Question Two continued over PAGE 3
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Question Two continued

Table Q2

Activity	Duration	Preceded By	Lead/Lag
A	4	–	
B	8	A	
C	6	B, D	
D	3	A	SS2
E	2	A	
F	5	E	FS1
G	6	A	SS3
H	3	E, G	
J	2	F	
		C	SS7
K	4	H	
		F	SS2
L	2	J	
		C	FS2
M	3	K	

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]

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Question Three continued

Table Q3.1

Activity	Predecessor	Duration (Day)	Cost/Day (£/Day)	Total Cost (£)
A	–	6	360	2160
B	–	2	375	750
C	A	8	475	3800
D	A, B	5	275	1375
E	B	3	450	1350
F	D, E	6	360	2160

Table Q3.2

Activity	Actual % Complete	Actual Cost (£)
A	100	2250
B	100	1000
C	30	1950
D	80	1500
E	100	1450
F	0	0

Question Four

(a) Provide a critical examination of the six key stages involved in Value Engineering. In your answer, describe the primary activities undertaken at each stage and the expected outputs or deliverables.

(12 marks)

(b) Critically assess the Project Risk Management process. Explain how the various phases of risk identification, analysis, evaluation, and response can be carried out, and discuss the principal techniques or tools applicable to each phase.

(13 marks)

[Total 25 marks]

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Question Five

A project manager (PM) has determined that 10 tasks would be needed to construct a project. Using the **PERT** three-estimate approach, the PM has obtained estimates for how long these tasks will take as presented in **Table-Q5**. The **Table-Q5** also shows the precedence relationships for these tasks as envisaged by the PM.

Table-Q5

Activity	Preceded by	Estimated Times (Days)		
		a (Optimistic)	*m* (Most likely)	*b* (Pessimistic)
A	-	4	8	15
B	-	8	10	20
C	-	11	12	15
D	C	13	15	20
E	B	2	3	4
F	A	2	3	5
G	A	3	4	8
H	G	1	2	3
I	D, E, F	5	8	12
J	H, I	3	5	7

(a) Using a Precedence diagram, draw a network diagram for this project.
(5 marks)

(b) Applying the Project Evaluation and Review Technique (PERT) calculate the expected time (t_e) and variance (v_e) for each task in the project and find the project mean duration (T) and standard deviation (S)
(10 marks)

(c) Find the probability to complete the project in 40 days
(5 marks)

(d) What is the duration of the project with at least a 80% confidence level?
(5 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

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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**

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Standard Normal Probabilities

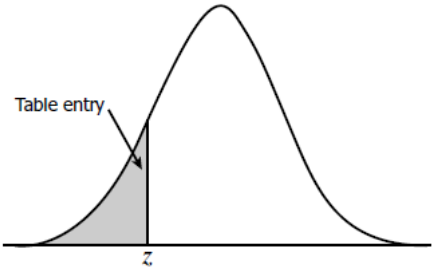

Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

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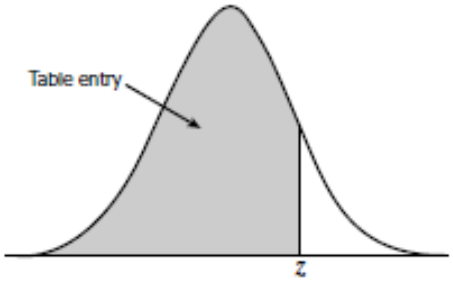

Table entry for z is the area under the standard normal curve to the left of z.

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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