

UNIVERSITY OF BOLTON

OFF CAMPUS DIVISION

WESTERN INTERNATIONAL COLLEGE FZE

MSC CONSTRUCTION PROJECT MANAGEMENT

TRIMESTER TWO EXAMINATION 2021/2022

PROJECT MANAGEMENT

MODULE NO: CPM7002

Date: Saturday 30th April 2022

Time: 10:00am – 1:00pm

INSTRUCTIONS TO CANDIDATES:

There are SIX questions on this paper.

Answer ANY FIVE questions.

All questions carry equal marks.

Marks for parts of questions are shown in brackets.

This examination paper carries a total of 100 marks.

Formula sheet / supplementary information is provided at the end of question paper.

All working must be shown. A numerical solution to a question obtained by programming an electronic calculator will not be accepted.

University of Bolton
Western International College FZE
MSc Construction Project Management
Trimester Examination 2021/2022
Project Management
Module No. CPM7002

Q1

a) Appraise the roles and responsibilities of a project manager, and critically evaluate the skills and attributes required to be an effective project manager.

7 marks

b) Analyse the standard “Triple Constraints” that typically impact project completion? Debate the significance of these constraints in construction project management.

6 marks

c) Critically appraise the planning process in project management and steps followed to develop a project plan or schedule.

7 marks

Total 20 marks

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PAST EXAMINATION PAPER

Q2

The information provided in below Table represents the activity dependencies to be followed for a construction project.

Activity	Predecessor	Activity duration in days
B	-	2
C	-	6
D	B	3
E	B	3
F	C	5
G	C	5
H	D	10
I	E	8
J	H	8
K	G	4
L	F, K	3
M	I, J	2
N	M	2
A	L, N	2

Complete the following tasks:

- a) Draw network diagram using Precedence Diagram.

6 marks

- b) Carry out forward and backward passes to determine earliest & latest start times and earliest & latest finish times for each activity and the network critical path

6 marks

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

3 marks

Q2 continues on the next page...

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Q2 continued...

- d) If the construction manager discovered that duration of activity G should be 10 days instead of 5 days and that of activity K should be 9 days instead of 4 days.

Analyse how this would affect the network critical path and the total duration of the project.

5 marks
Total 20 marks

Q3

a) Critically evaluate the term “Value Management (VM)” and analyse its benefits. Suggest how Value Management (VM) is different from Value Engineering (VE).

6 marks

b) Deliberate the six main steps of value engineering, and the main tasks and outcomes of each step.

6 marks

c) Critically appraise the process of Project Risk Management and propose how each stage of risk analysis / risk response could be conducted using the available techniques / tools.

8 marks
Total 20 marks

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Q4

An international construction company based in Dubai has been awarded a contract to construct a state-of-the-art performance arts theatre complex in Abu-Dhabi. The project manager intends to use the PERT method for project time estimation and analysis. The table below specifies the main activities involved in the construction process, dependencies/precedence relationships and 3-point time estimates

Activity Reference	Dependency/Preceding Activity	3-Point Time Estimates (weeks)		
		Optimistic	Most Likely	Pessimistic
A1	None	20	44	44
A2	None	40	40	40
A3	None	8	20	32
A4	A1	8	28	64
A5	A2, A3	16	16	40
A6	A2, A3	16	28	40
A7	A2, A3	8	8	8
A8	A3	4	24	32
A9	A7, A8	12	32	76
A10	A4, A5	4	16	28

a) Construct a network diagram for the project and determine the mean project duration and mean critical path using PERT estimation.

10 marks

b) The investors and stakeholders are interested in having the project completed earlier than originally intended to allow ample time for preparation for UAE-Expo 2020. Using the z-statistic probability table provided, determine the approximate probability of completing the construction of the theatre complex in 85 weeks.

5 marks

c) The construction company is looking for early completion of the theatre to bag a sizeable bonus. The company wishes to put forward a revised time for completion but have asked for a 90% probability that this date will be achievable. What value for project duration will give this level of certainty of completion?

10 marks

Total 20 marks

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Q5

a) Analyse the main objectives of Time / Cost optimisation when associated with network analysis techniques and propose how these can be achieved.

4 marks

b) **Figure Q5** and **Table Q5** below define the construction activities and cost prepared by a contractor involved in the construction of a small office block. The client wishes to know how the cost of the project would be influenced by a variation of the overall project duration (stated in the project documents as 49 weeks)

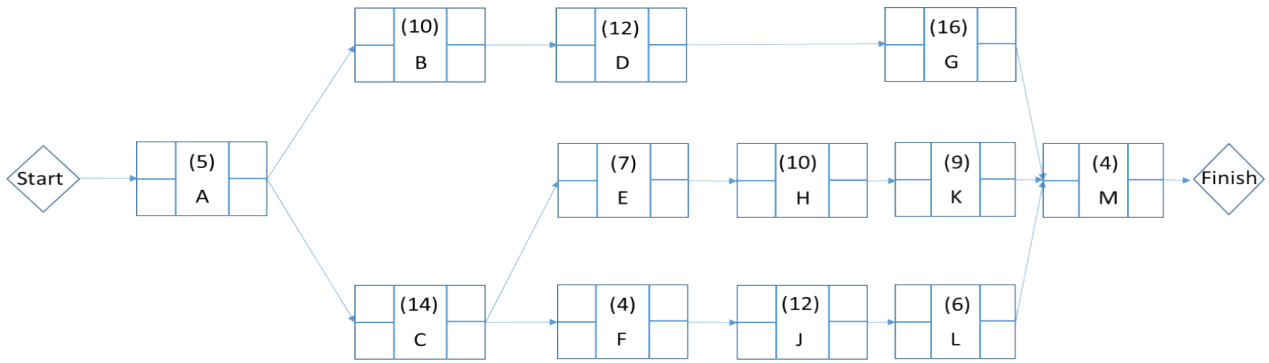


Figure Q5

Table Q5

ACTIVITY	NORMAL		CRASH	
	Duration (Weeks)	Cost (S)	Duration (Weeks)	Cost (\$)
A	5	300	3	600
B	10	275	10	275
C	14	500	13	610
D	12	600	8	1200
E	7	120	6	240
F	4	200	3	290
G	16	500	10	980
H	10	600	6	840
J	12	520	10	800
K	9	600	7	800
L	6	485	6	485
M	4	150	3	200

Q5 continued over the page...

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Q5 continued

The client requires the work to be completed in 44 weeks, although he is apprehensive of the additional cost that he will incur in shortening the project duration.

- a) Determine the **optimised direct cost** of carrying out the project from the specified 49 weeks to the preferred 44 weeks.

8 marks

- b) Determine the **optimum contract duration** when overheads & other indirect costs totalling \$165 per week are taken into account. State the associated project cost.

8 marks

Q6

a) Appraise the Earned Value Management (EVM) technique in project management and critically evaluate its objectives and benefits?

6 marks

b) A project was planned for a budget of \$200,000 and duration of 12 months. At the end of month four, it was found that only 25% of the project was completed for a cost of \$75,000. Using the Earned Value method, find the following:

(i) The project CV, SV, CPI, SPI at this stage.

8 marks

(ii) Analyse the status of the project at this stage and forecast the new budget (EAC) to complete the project if the project continued to perform at the same rate.

6 marks

Total 20 marks

END OF QUESTIONS

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SUPPLEMENTARY INFORMATION AND USEFUL FORMULAE/TABLES

PERT FORMULAS

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

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

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

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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Standard Normal Probabilities

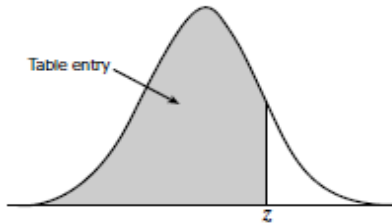


Table entry for z is the area under the standard normal curve to the left of z .

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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EVM FORMULAS

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.	$CPI = EV / AC$

Name	Formula	Interpretation (As of today ...)
Cost Variance (CV)	$EV - AC$	NEGATIVE is over budget, POSITIVE is under budget.
Schedule Variance (SV)	$EV - PV$	NEGATIVE is behind schedule, POSITIVE is ahead of schedule.
Cost Performance Index (CPI)	$\frac{EV}{AC}$	We are getting \$ _____ worth of work out of every \$1 spent. Funds are or are not being used efficiently.
Schedule Performance Index (SPI)	$\frac{EV}{PV}$	We are (only) progressing at _____ percent of the rate originally planned.
Estimate at Completion (EAC) NOTE: There are many ways to calculate EAC, depending on the assumptions made. The first formula to the right is the one most often asked on the exam.	$\frac{BAC}{CPI}$ $AC + ETC$ $AC + (BAC - EV)$ $AC + \frac{(BAC - EV)}{CPI}$	As of now, how much do we expect the total project to cost? \$ _____. See formulas at the left. <ul style="list-style-type: none"> Used if no variances from the BAC have occurred or you will continue at the same rate of spending. Actual plus a new estimate for remaining work. Used when original estimate was fundamentally flawed. Actual to date plus remaining budget. Used when current variances are thought to be atypical of the future. AC plus the remaining value of work to perform Actual to date plus remaining budget modified by performance. Used when current variances are thought to be typical of the future.
Estimate to Complete (ETC)	$EAC - AC$	How much more will the project cost?
Variance at Completion (VAC)	$BAC - EAC$	How much over or under budget will we be at the end of the project?

END OF PAPER