UNIVERSITY OF BOLTON

SCHOOL OF ENGINEERING

MSc CIVIL ENGINEERING
MSc CONSTRUCTION PROJECT MANAGEMENT

SEMESTER ONE EXAMINATION 2018/2019

PROJECT MANAGEMENT

MODULE NO: CPM7002

Date: Monday 14th January 2019   **Time: 14:00 – 17:00**

INSTRUCTIONS TO CANDIDATES: This paper contains two sections: section 'A' and section 'B'

Section A contains **ONE** question: you MUST answer this question. It is worth 40 marks.

Section B contains four questions: you should answer **ANY THREE** questions from these four questions. Each of these questions is worth 20 marks.

Marks for parts of questions are shown in brackets.

This examination paper carries a total of 100 marks.

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

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Section A – <u>COMPULSORY</u> Question

Question One

The information provided in **Table Q1** represents the activity dependencies to be followed for a construction project.

Activity	Duration (days)	Predecessor
A	4	--
B	10	A
C	2	A
D	6	C
E	15	B, D
F	4	B, D
G	3	F
H	2	B, D
I	1	E, G, H
J	3	I
K	2	E
L	1	J
M	2	K, L

Table Q1

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Question 1 continued….

Complete the following tasks:

(a) Draw a network diagram for the above activities using precedence diagram.
(12 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.

(12 marks)

(c) Calculate the Total Float (TF), Total Time Available (TTA) and Free Float (FF) for all non-critical activities **(12 marks)**

(d) What would be the effect of delay in activity K by 3 days on the network critical path and the overall project duration? **(4 marks)**

Total 40 marks

Section B – Answer <u>ANY THREE</u> questions

Question Two

(a) Appraise the roles and responsibilities of a project manager, and critically discuss the skills and attributes required to be effective in this role.
(10 marks)

(b) 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.
(10 marks)

Total 20 marks

Question Three

(a) Critically discuss the six main steps of value engineering, and the main tasks and outcomes of each stage. **(10 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. **(10 marks)**

Total 20 marks

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Question Four

The network diagram in **Figure Q4** represents a planning programme for construction activities in a project as viewed by the construction manager. Activities duration are given in weeks.

(i) Analyse the network and determine the earliest start and latest finish times for each activity together with the network critical path.

(10 marks)

(ii) All project activities in **Figure Q4** require continuous craneage. The contractor owns one crane costing £1575/week and the cheapest crane hire would cost £1980/week. Produce a full annotated bar chart for the activities on the graph paper provided (use landscape orientation) and determine the **minimum cost** of craneage to the contractor.
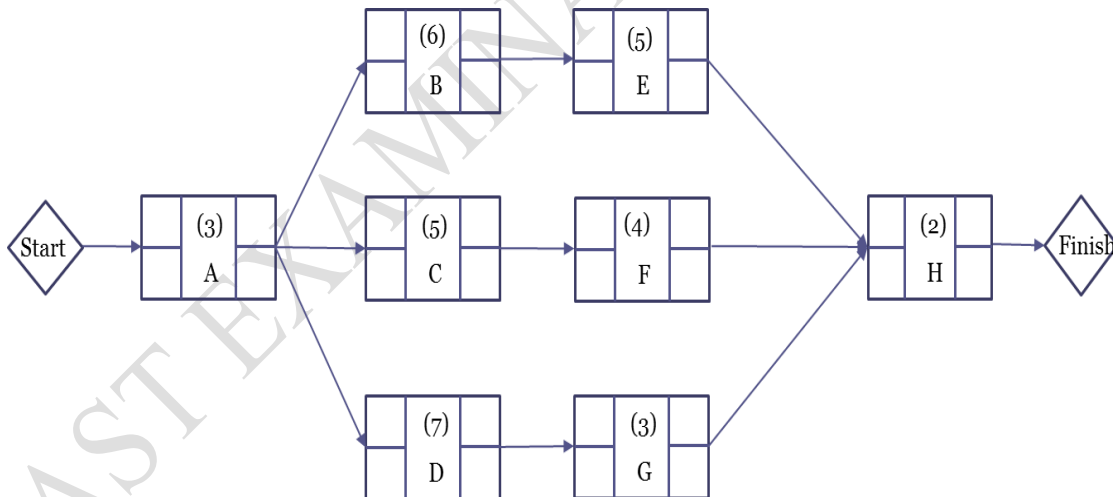
(10 marks)

Total 20 marks

Figure Q4

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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 project network for this project.   **(5 marks)**

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

(c) Find the mean critical path.   **(5 marks)**

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

Total 20 marks

END OF QUESTIONS

Formula sheets over the page….

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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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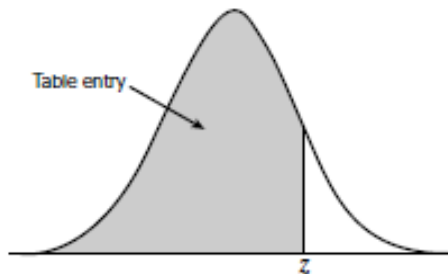Module No: CPM7002

Standard Normal Probabilities

Table entry

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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