FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science and Technology (CEST)

School of Electrical & Electronic Engineering

BACHELOR OF ENGINEERING & ADVANCED DIPLOMA IN ENGINEERING (ELECTRICAL & ELECTRONICS)

EEE601 – ENGINEERING PLANNING

FINAL EXAMINATION - SEMESTER 1

DAY/DATE: - MAY/2013. TIME: 9.00pm - 12:10pm.

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each Section on a fresh page and use both sides of the sheet.
3. Write your candidate – number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. There are **TWO (2)** parts to this examination.
8. Part I : **Question 1** is **COMPULSORY**
9. Part II: You are to answer THREE (3) more questions from the remaining questions.
10. THIS IS AN OPEN BOOK EXAMINATION AND YOU ARE ALLOWED TO BRING INTO THE EXAMINATION ROOM MATERIALS THAT ARE USEFUL TO THIS EXAM.
11. CANDIDATES ARE NOT ALLOWED TO EXCHANGE NOTES OR MATERIALS DURING THE COURSE OF THIS EXAMINATION.

QUESTION 1 (40 marks total)

This question is compulsory. All candidates must attempt this question.

(i) A project has eight (8) activities identified by the code letters given on the Table 1 below. Table 1 below identifies the sequence in which the activities must be undertaken. Construct a network for the project. (10 marks)

Activity	Code Letter of Any Immediately Preceding Activity or Activities
A	--
B	--
C	B
D	A
E	A,B
F	A
G	C, E
H	C

Table 1.

A CPM network for another different project is drawn in figure 1 below. Activity times, in days, are indicated by the numbers that appears under each activity arrow.

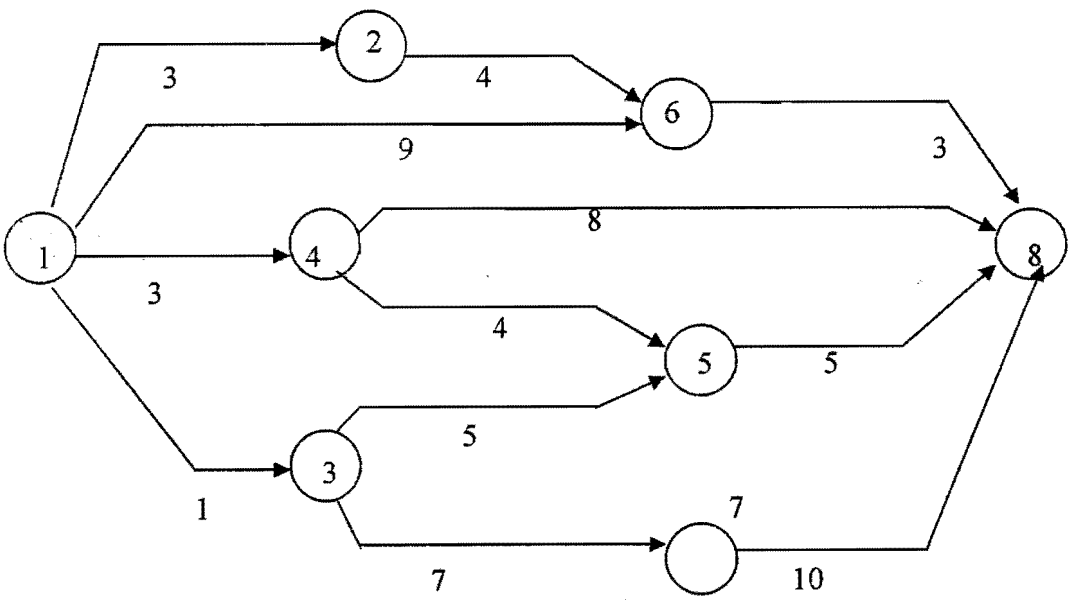

Figure 1.

(ii) Do analyse the network above and find the earliest and latest **event** times, and the minimum duration of the project.

(6 marks)

(iii) What amount of free float is associated with activity 2-6?

(2 marks)

(iv) Draw a neat sequenced bar chart for the above project with all activities shown at their earliest times.

(6 marks)

The number of people required for each activity involved in the project, is shown in the following table, table 2 below. The duration of individual activities cannot be altered by the allocation of additional people, nor may activities be divided into smaller components performed at different times.

Activity	People Required Per Day
1-2	6
1-3	4
1-4	7
1-6	3
2-6	2
3-5	1
3-7	1
4-5	5
4-8	6
5-8	4
6-8	3
7-8	2

Table 2.

(v) Indicate the number of people required for each day of the project with all activities at the earliest times

(2 marks)

(vi) By making use of the floats in the various activities, smooth the daily requirement for people as much as possible. What is the minimum ceiling of people required to complete the project in minimum time? Justify your answer by redrawing the bar chart and indicating the people required on each day.

(4 marks)

(vii) For the CPM network figure 2 shown on the following page, the normal and crash durations for the activities in the project, and their associated costs are shown in the table 3 underneath the network. Indicate what activity or activities should be crashed to reduce the project time by:

(a) 2 days

(b) 4 days

Estimate the increased costs that are in each case. (10 marks)

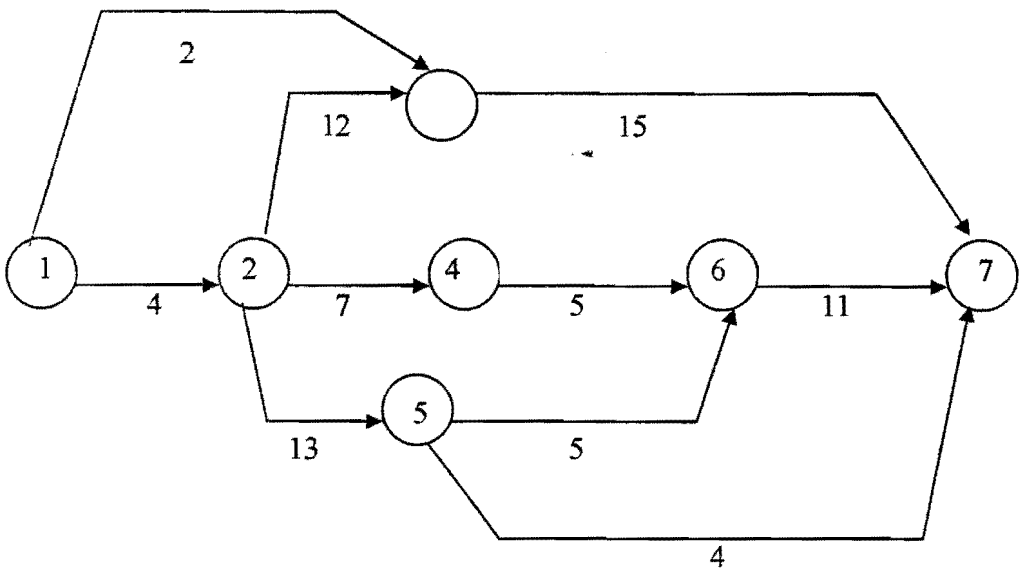

Figure 2.

Activity	Normal Duration		Crashed Duration	
	Days	Cost ($)	Days	Cost ($)
1-2	4	200	3	230
1-3	2	250	2	250
2-3	12	1200	10	1400
2-4	7	1200	6	1300
2-5	13	1500	10	1800
3-7	15	10	10	200
4-6	5	250	3	310
5-6	5	150	5	150
5-7	4	150	3	175
6-7	11	75	6	175

Table 3.

ATTEMPT THREE (3) OF THE FOLLOWING QUESTIONS

QUESTION 2 (20 marks total)

(a) A section of a building project involves filling a certain under floor area with gravel. Before this can be done it is essential that lead up work and the under floor services are completed. The activities involved in this section of the work are listed below together with their duration times. Dependencies between various activities are as follows:

The gravel cannot be started until at least 3 days after the brick work below the d.p.c (damp proof course) has been completed, but may start immediately the drainage under he building and the main laying under the building are finished.

The completion of the drainage follows after drainage under the building and the external electrical main laying after laying under the building.

The external pavement may be laid after the 'external electrical main laying' and 3 days after the 'brickwork below the d.p.c' is completed.

The completion of the drainage and external electrical main laying must be completed before the internal services.

	Activities Involved	Duration (Days)
1.	Finish drainage under building	3
2.	Finish brickwork below d.p.c	1
3.	Finish electrical main laying under building	2
4.	Complete drains	3
5.	Complete external electrical main laying	2
6.	Laying external pavement	2
7.	Install internal services	4
8.	Fill with gravel	1

Table 4.

Draw an Method of Potentials (MoP) network for the above situation, inserting all relevant information on the network and appropriately marking the critical path.

(12 marks)

(b) Using a CPA, the JJ's Boat Building Co. of Fiji was able to determine that the expected completion time for the construction of a tug boat was 21 months and the project variance was 4 months.
What is the probability that the project would be completed in

(i) 17 months?
(ii) 20 months?
(iii) 23 months?
(iv) 25 months ?

(8 marks)

QUESTION 3 (20 marks total)

A hardware manufacturing company builds two types of debris bins - Compact and Green Enviro. The production of each bi involves a certain amount of moulding, pressing and assembly as table below shows.

Department	Debris Bin	
	Compact	Green Enviro
Moulding	5 hours	6 hours
Pressing	8 hours	5 hours
Assembly	9 hours	14 hours

Table 5.

The following month the company has maximum available capacities of 630 hours for assembly, 300hours for moulding and 400hours for pressing. The company has advance orders for 5 Compact debris bins and fro 10 Green Enviro bins and is committed to supply these the following month. The same profit of $6,000 is made from the company sale of each debris bin.

(i) How many Compact and Green Enviro debris bins should e manufactured the following month to fulfill advance orders and maximize profits? How much profit will be made? (assume that partially completed debris bins can be manufactured but only completed bins can be sold for profits. Bins on advance order have not yet been paid for.)

(14 marks)

(ii) At the optimum production mix for the following month, which if any, of the three departments has any excess capacity, i.e. hour available that are not used? Indicate the amount of any excess capacity in hours.

(2 marks)

(iii) If the profit from the sale of each Enviro debris bin increase from $6,000 to $15,000 because of its appearance on a popular TV gardening show, how would this affect the proposed production mix for he coming month?

(4 marks)

QUESTION 4 (20 marks)

A concrete company at Nasinu has two suppliers of sand and gravel from Naitasiri. The material from the first supplier is not as clean as the second. The price from either source depends on the quarry cost, carting and refining. The amount of each grade of rock and sand required for the production of concrete culvert, ready-mix and other products is well known for one month in advance, but it changes from month to month as a function of demand.

The necessary cost and quantity relationships for a given month are tabled in table 6 below.
Note: use the American ton, i.e. 1 ton = 2000lbs.

Aggregate	lbs per ton		Tons required
	Supplier 1	Supplier 2	
½" to 2 "	600	200	10 000
4 mesh to ½"	800	600	15 000
50 mesh to 4 mesh	400	900	20 000
Less than 50 mesh	100	30	5 000
Cost per ton	$1.51	$1.68	

Table 6.

(i) Give the restrictions and objective functions. (3 marks)

(ii) Draw the graphs showing the restriction lines as follows: the objective function line is: $1.5S_1 + 1.68S_2 =$ minimum

(5 marks)

(iii) Determine the point at which the cost will be lowest and at which there will be sufficient aggregate to meet requirements.

(5 marks)

(iv) Use this values in (iii) to determine the excess or shortage of the aggregates and the total cost

(7 marks)

QUESTION 5 (20 marks)

A heavy truck parts maker is able to tender on a pre-production study contract of a new type of truck ventilator unit worth $25,000 net profit if it wins the contract. Tendering costs would be about $2,000. The chances of winning the contract is 50 per cent.

If the company wins the contract, it must decide on he level of marketing id should make to increase its chances of getting further production contract worth $55,000 net profit. Promotion at a high level costs $18,000 with a resulting probability of winning the contract of 0.8. At medium level promotion it costs $12,000 with a probability of 75 per cent and at a low level it costs $8,000 with a probability of 60 per cent.

Should the initial study contract be lost, the company can still bid on the production contract at an additional tender cost of $6,000. The probability of winning the production contract from this sage is 30 per cent.

If the initial study id not tendered for, a tender for the production contract ma be made at a cost of $16,000 with a probability of winning the contract estimated at 25 per cent.

(i) Draw a decision tree to show the relationship between the various options which arise as the problem unfolds. Show also the cost of various decision, the probabilities of winning or losing the tender, the optimal profit path on the decision tree.

(9 marks)

(ii) Draw a decision tree for the analysis of each decision and chance node and give the final profit from this contract for production.

(11 marks)

The End

Tables of the Normal Distribution

Probability Content from -oo to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990