



PROGRAM : BACHELOR OF TECHNOLOGY
ENGINEERING: INDUSTRIAL

SUBJECT : PROJECT ENGINEERING

CODE : IPE 411

DATE : WINTER EXAMINATION 2016
28 MAY 2016

DURATION : (SESSION 2) 12:30 - 15:30

WEIGHT : 40: 60

TOTAL MARKS : 100

ASSESSOR : MR P. DUBE

MODERATOR : MR O. CHIMUSORO

NUMBER OF PAGES : 5 PAGES

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS.

REQUIREMENTS

ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.

Question 1

- 1.1 Really Big Ideas, Inc., a small company that develops inventions for the consumer market, has recruited you as a consultant to make a recommendation on a critical business decision. At 10:00 a.m., you meet Adam Smith, the Vice President in charge of product development. Smith expresses his wish for an outside opinion on a decision the company must make soon. Your job is to supply such an informed opinion. Smith tells you that a short meeting will provide all the information needed and introduce the project managers for two possible (and competing) products.

As Smith ushers you into a conference room he also mentions that he expects your analysis by 11:00 a.m., scarcely an hour from now! You are given pen, paper, and a calculator. At 10:05 a.m., you and Smith enter a small meeting room. Smith explains that Really Big Ideas has a three-month window of opportunity to develop a new product using new pattern recognition software the company recently created. Surprisingly, the software adapts easily to different applications. Really Big Ideas only has the resources and time to develop one of two projects, or to develop none. Project Managers Aisha Ali and Ben Bertrand arrive. After brief introductions, Aisha Ali launches her pitch. She says that a smoke and fire detector is the best project to make. The detector goes beyond ordinary smoke detectors. It can detect flames as well as smoke. It will cost R100,000 to develop, and if it succeeds the Business Analysis department says it will generate revenue of R1,000,000. Not to be outdone, Ben Bertrand announces that a motion detector device is the best project to develop. The motion detector, which uses conventional household lighting, will only cost R10,000 to develop. He adds that the analysts expect such a device to generate R300,000 in revenue. Smith asks if you have any questions, so you carefully ask about the chances for success. Both project managers agree that Samiksha Singh, the Director of the Business Analysis department, has that information. Smith initiates a conference call with Samiksha Singh. Singh informs the meeting that the smoke and fire detector has a 50% chance of success, and that the motion detector has an 80% chance of success. Smith thanks all the participants and ends the meeting. It is now 10:30 a.m. Smith announces that he'll return within the hour to see if you have decision analysis. Smith leaves you with your notes, paper, pen, and a calculator.

Vice President Adam Smith of Really Big Ideas, Inc. calls you the following day. He reports that the company has learned new information that may affect the decision. Smith wants to know if you can prepare a new analysis using the new information. Smith tells you that the proposed smoke and fire detector must pass an Underwriters Laboratories (UL) safety certification before it can be sold. (Such certification is not necessary for the motion detector). Director Samiksha Singh has interviewed a UL inspector and learned how the certification process works. Singh has modified the marketing and success estimates based on the new information. She now reports the following:

- A commercial grade certification will result in R1,000,000 sales (as originally expected). However, the likelihood of obtaining the coveted commercial certification is only 30% due to the stringent standard.
- A less-stringent residential grade certification is 60% likely, but would result in only R800,000 sales.
- There is a 10% chance that the smoke and fire detector will not pass any certification test. In this case—a complete failure—the company will lose the initial R100,000 investment cost.
- Underwriters Laboratories charges a R5,000 non-refundable fee for the certification application.

Can you help Really Big Ideas to decide which product, if either, to develop? How can you evaluate the alternatives in a measurable way given the various uncertainties involved? You can use a decision tree to describe and then to evaluate the decision alternatives. (14)

- 1.2 Graham Incorporated uses discounted payback period for projects under R25,000 in Table Q1 and has a cut off period of 4 years for these small value projects. Two projects, R and S are under consideration. The anticipated cash flows for these two projects are listed below. If Graham Incorporated uses an 8% discount rate on these projects are they accepted or rejected? If they use 12% discount rate? If they use a 16% discount rate? Why is it necessary to only look at the first four years of the projects' cash flows? (6)

Table Q1

	Project R	Project S
Initial Cost	R24,000	R18,000
Cash flow year one	R6,000	R9,000
Cash flow year two	R8,000	R6,000
Cash flow year three	R10,000	R6,000
Cash flow year four	R12,000	R3,000

[20 marks]

Question 2

In the following table, Table Q2, are precedence requirements, normal and crash activity times, and normal and crash costs for a construction project.

Table Q2

	Predecessor	Normal		Crash	
		Time	Cost	Time	Cost
A	-	10	R5000	10	R5000
B	-	12	R1200	11	R1300
C	A,B	11	R3600	9	R4800
D	C	5	R300	4	R600
E	C	8	R1000	6	R2000
F	C	9	R2400	7	R5400
G	D,E,F	8	R700	7	R1000

- 2.1 What are the critical activities and the estimated completion time? (3)

- 2.2 To shorten the project by three weeks, which tasks would be shortened and what would the final total project cost be? (10)

[13 marks]

Question 3

- 3.1 From the following information (Table Q3), draw the project network. (3)
- 3.2 Compute the early, late, and slack times for each activity. Identify the critical path. (5)
- 3.3 Develop a Linear Programming model for the network (10)

[18 marks]

Table Q3

ID	Duration	Finish-to-Start Predecessor	Finish-to-Start Lag	Additional Lag Relationships	Lag
A	2	None	0	None	0
B	4	A	0	None	0
C	6	A	0	Finish-Finish C to F	7
D	8	A	0	None	0
E	18	B	0	Finish-Finish E to G	9
		C	10		
F	2	D	0	None	0
G	5	F	0	Start-start G to H	10
H	5	None	0	None	0
I	14	E	0	Finish to finish I to J	5
J	15	G,H	0	None	0

Question 4

The following information Table Q4 has been collected from a project

Table Q4

Activity	Predecessor	Optimistic Estimate	Most Likely Estimate	Pessimistic Estimate
A	-	1	2	3
B	A	2	3.5	8
C	B	6	9	18
D	C	4	5.5	10
E	C	1	4.5	5
F	E	4	4	10
G	D	5	6.5	11
H	E,G	5	8	17
I	C	3	7.5	9
J	F,I	3	9	9
K	J	4	4	4
L	J	1	5.5	7
M	H	1	2	3
N	K,L	5	5.5	9

- 4.1 Compute the expected time for each activity. (7)
- 4.2 Compute the variance for each activity. (7)
- 4.3 Compute the expected project duration. (4)
- 4.4 What is the probability of completing the project by day 47? (4)

[20 Marks]

Question 5

You have prepared the following schedule for a project in which the key resource is a tractor. There are three tractors available to the project. Activities A and D require one tractor to complete while activities B,C,E and F (Figure Q5) require two tractors.

Develop a resource constrained schedule in the loading chart provided. Use the parallel method and heuristic given. Be sure to update each period as computer would do. Record the early start (ES), late finish (LF) and slack (SL) for the new schedule

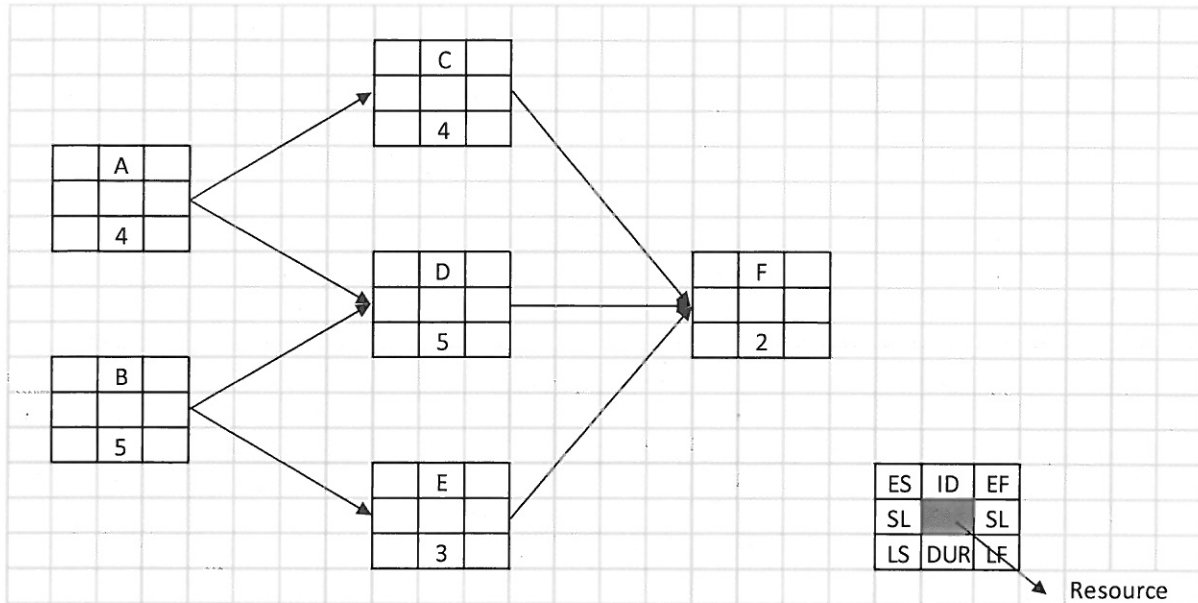
[14 Marks]

Figure Q5

Question 6

- 6.1 What are some of the key environmental forces that have changed the way projects are managed? What has been the effect of these forces on the management of projects? (3)
- 6.2 What is meant by an integrative approach to project management? Why is this approach important in today's environment? (3)
- 6.3 Explain the role projects play in the strategic management process. (3)
- 6.4 How are projects linked to the strategic plan? (3)
- 6.5 The portfolio of projects is typically represented by compliance, strategic, and operations projects. What impact can this classification have on project selection? (3)

[15 marks]