Tutorial letter 203/1/2017

Software Project Management

INF3708

Semester 1

School of Computing

IMPORTANT INFORMATION:

This provides the solutions to INF3708 assignment 03 for semester 1.

Solution for Questions on Chapter 5 and 6 - Activity Planning

QUESTION 1 **[10 Marks]**

Due to several reasons, software effort estimations are carried at various stages of a software projects. These include:

Strategic planning stage: at this stage, the costs and benefits estimations are done for new applications in order for priorities to be allocated.

Feasibility study stage: Software effort estimation is done at this stage to confirm if the benefits of the potential system will justify the costs.

System specification stage: At this stage, effort needs to be estimated on the implementations of different design proposals. Efforts are also estimated at this stage to confirm that the feasibility study is still valid.

Evaluation stage:

Project planning stage: Estimates performed at this stage will confirm earlier broad-brush estimate, and will support more detailed planning, especially staff allocations.

QUESTION 2 **[10 Marks]**

2.1 Differentiate between waterfall and prototyping as software project development models. (5)

Answer

A prototype is a working model of one or more aspects of the projected system. It is a development approach that is constructed and tested quickly and inexpensively in order to test out assumptions.

This approach enables organisations to reduce uncertainty.

Prototype is an approach that: allows learning by doing; improves communication and user involvement.

Waterfall is a classical model development that is also known as one-shot. Waterfall model consist of sequence of activities working from top to bottom.

It is a development method that is linear and sequential.

Waterfall is a suitable approach where the requirements are well defined and the development methods are well understood. The approach allows project completion times to be forecast with some confidence, allowing the effect control of the project

2.2 As a potential project manager, indicate some of the reasons why you will not recommend waterfall model to your project team as an appropriate project approach? (5)

Answer

The answers to this question are the disadvantages of waterfall model which include:

- Waterfall is a less effective approach where: (1) Requirements are not well defined at the beginning.
- (2) Development methods are not well understood.
- Waterfall is also a less effective approach where there is uncertainty about how a system is to be implemented. This is because it is a less flexible approach. Approaches that can handle uncertainty about system implementations require more flexibility and iteration.
- Waterfall is often very useful for large and high risk projects
- With waterfall model, no working system/software is produced until later in the development.

Question 3 **[20 marks]**

3.1. COCOMO is a cost estimation model that was built around equation. Provide the equation and describe the variables in Boehm's equation for calculating effort in the use of the COCOMO model. **(5 mark)**

Answer

Boehm's equation:

effort = c* (size)*k (1 mark)

Variables in Boehm's equation:

Effort: measured in person months consisting of 152 working hours (1 mark)

Size: measured in thousands of delivered source code instructions (kdsi) (1 mark)

c and k are constants:

The constants, c and k, depended on whether the system could be classified, in Boehm's terms, as "organic", "semi-detached" or "embedded" (2 mark)

These relate to the technical nature of the system and the development environment.

3.2. Five systems with the following estimated lines of code were identified. Identify which can be completed in three years. (15 mark)

Answer

A	$=3.0*(17862/1000)^{1.12}$	=	75.73	Person months/12 = years	=	6.31 years
B	$=3.0*(10762/1000)^{1.12}$	=	42.93	Person months/12 = years	=	3.58 years
C	$=2.4*(22132/1000)^{1.05}$	=	62.01	Person months/12 = years	=	5.17 years
D	$=3.6*(7253/1000)^{1.20}$	=	38.80	Person months/12 = years	=	3.23 years
E	$=3.6*(6434/1000)^{1.20}$	=	33.61	Person months/12 = years	=	2.80 years
	(5 marks)		**(5 marks)**			**(5 marks)**

QUESTION 4 (39 marks)

4.1 CPM and PERT are the two best known project scheduling techniques models. Compare and contrast (i.e the similarity and differences) between CPM and PERT. (10)

4.2 Using the information in table 2 below

Activity	Duration (Working days)	Precedents
A	5	None
B	15	A
C	25	B
D	15	B
E	30	B
F	10	C,D
G	10	E,F
H	5	G
I	5	H

Table 2 for Question 4

4.2.1 Consider the following list of tasks with dependencies and estimated durations reflected in the table. Draw a CPM network (activity-on-arrow diagram) to illustrate the interaction of activities [15]

4.2.2 Write down the critical path using the letters of the tasks. Calculate and write down the duration of the project. Identify all the remaining other paths and Calculate the duration. [4]

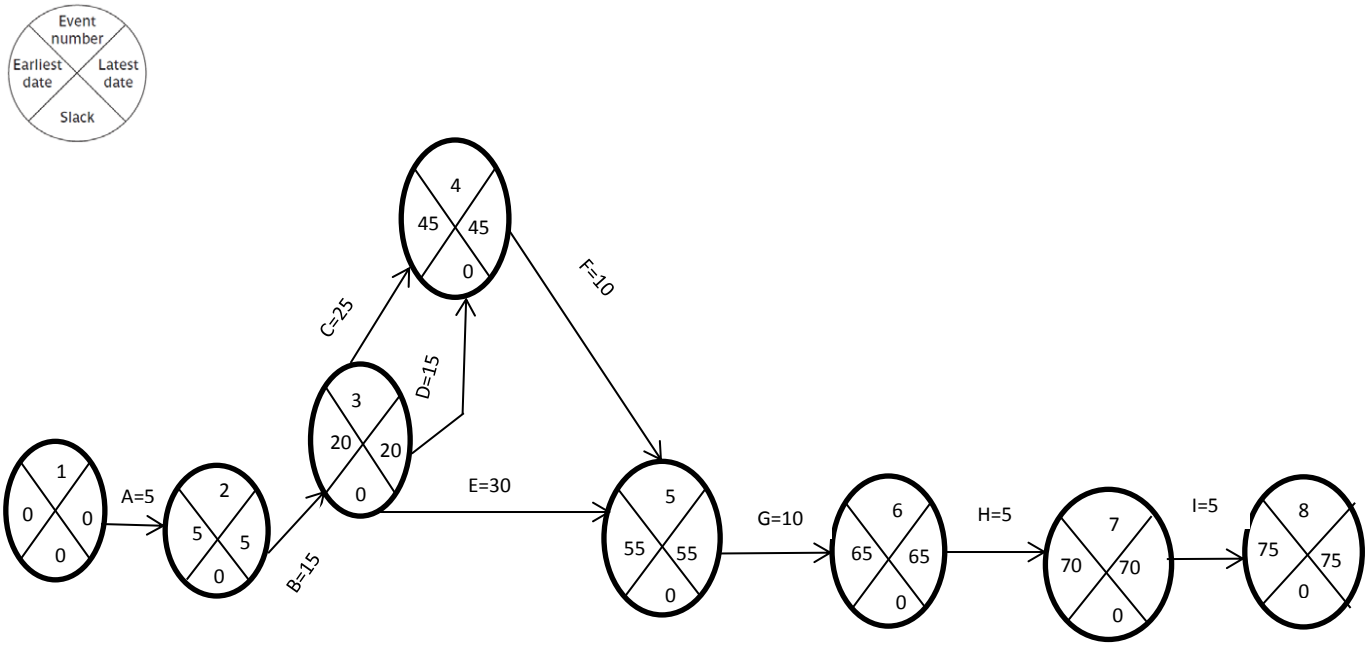
4.2.3 In a table format, calculate the earliest start time, earliest finish, latest start time, latest finish and total float of the tasks for the activity-on-arrow network. [10]

ANSWERS

4.1

Similarity	**Difference**
Both PERT and CPM use the expected durations of the activities to carry out a forward pass through a network.	CPM uses single estimate for the duration of each task while PERT requires three combined estimates (namey: Most likely; Optimistic time; and Pessimistic time) to form a single duration.
PERT and CPM are project scheduling technique that shows/model projects activities, relationships and dependencies on a network.	Unlike the CPM approach, the PERT method does not indicate the earliest date by which a project could be competed but the expected date.
PERT and CPM are both referred to as network analysis, programming models and critical path analysis (CPA)	Unlike PERT, CPM approach allows an explicit estimate of costs in addition to time meaning that CPM is able to control both cost and time.
Both PERT and CPM are project management techniques and scheduling tools that allows managers to plan, manage and control complex tasks and projects.	An advantage of PERT approach over CPM is that it places emphasis on the uncertainty of the real world and on the uncertainty of the estimation of activity duration.
Both of these techniques uses an activity-on-arrow approach to joining circles, or nodes, which represent the possible start and/or completion of an activity or set of activities.	PERT is a more suitable approach for project performed for the first time where the estimate of duration are uncertain while CPM is best suited for routine and projects where time and cost estimates can be accurately calculated.

4.2.1 [15]



4.2.2 Write down the critical path using the letters of the tasks. Calculate and write down the duration of the project. Identify all the remaining other paths and Calculate the duration. [4]

ANSWER

The critical path is: A-B-C-F-G-H-I

5+15+25+10+10+5+5 = 75

Other path include: A-B-D-F-G-H-I

5+15+15+10+10+5+5 = 65

: A-B-E-G-H-I

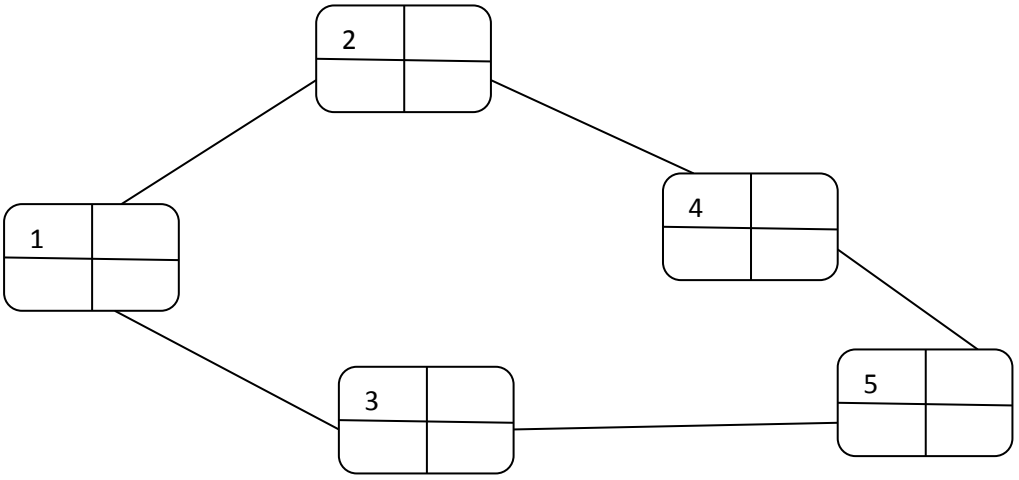
5+15+30+10+5+5 = 70

4.2.3 In a table format, calculate the earliest start time, earliest finish, latest start time, latest finish and total float of the tasks for the activity-on-arrow network. [10]

Activity	Duration	Earliest start date	Latest start date	Earliest finish date	Latest finish date	Total Float
A	5	0	0	5	5	0
B	15	5	5	20	20	0
C	25	20	20	45	45	0
D	15	20	30	35	45	10
E	30	20	25	50	55	5
F	10	45	45	55	55	0
G	10	55	55	65	65	0
H	5	65	65	70	70	0
I	5	70	70	75	75	0

QUESTION 5 [21]

In the PERT network illustrated in the figure below, the target date for the completion of the project is 15 weeks.



Pert network for Question 2

	Optimistic (a)	Most Likely (m)	Pessimistic (b)	Expected (te)	Standard Deviation (s)
A	2	4	6.50		
B	6	7	7.50		
C	1	2	5.50		
D	2.50	4.50	5.50		
E	5	6	7		

Table for Question 2

Use the table above to calculate the following:

5.1 Calculate the Expected activity duration (te) values for all activities and use it to carry out a forward pass through the network depicted on figure 1. (5)

Calculate Standard Deviation (s) for all the activities (5)

Calculate standard deviation (s) for all the tasks of figure. Indicate your (s) values on figure 1 also. Show all your calculations. (4)

5.2 Based on your calculation of (te), what is the project duration? State it in weeks. (2)

5.3 Calculate the Z value on the last event.

(3)

5.4 According to Figure 7.8 (p.181) in your textbook, what is the probability of not meeting the target date?

(2)

Answer for question 5.1 to 5.4

5.1 Calculate the Expected (te) values for all activities and use it to carry out a forward pass through the network depicted on figure 1. (5)

Use the formula below to calculate the te values of each activity:

$$\frac{a+4m+b}{6}$$

*Calculating the te value of Activity A: te = (2+(4*4)+6.50)/6 = 24.5/6 = 4.08*

*Calculating the te value of Activity B: te = 6+(7*4)+7.50)/6 = 41.50/6 = 6.91*

*Calculating the te value of Activity C: te = (1+(4*2)+5.50)/6 = 14.50/6 = 2.41*

*Calculating the te value of Activity D: te = (2.50+(4*4.50)+5.50)/6 = 2816 = 4.33*

*Calculating the te value of Activity E: ie = (5+(4*6)+7)/6 = 2416 = 6*

Calculate Standard Deviation (s) for all the activities (5)

Use the formula below to calculate the **s** values of each activity:

$$s = \frac{b - a}{6}$$

Calculating the s value of Activity A: s = (6.50-2)/ 6 *= 4.50/6 = 0.75*

Calculating the s value of Activity B: s = (7.50-6)/6 = 1.50/6 = 0.25

Calculating the s value of Activity C: s = (5.50-1)/6 *= 4.50/6 = 0.75*

Calculating the s value of Activity D: s = (5.50-2.50)16 *= 3/6 = 0.5*

Calculating the s value of Activity E: s = (7-5)/6 *= 2/6 = 0.33*

Calculate standard deviation (s) for all the tasks of figure. Indicate your (s) values on figure 1 also. Show all your calculations (4)

The **sd** *for event 2* is *the* **s** *value for Activity A, i.e. = 0.75*
The **sd** *for event 3* is *the* **s** *value for Activity B, i.e. = 0.25*

The **sd** *for event 4* is *total SO of A* + C

= *(sd of event 2)'* + (s *of Activity C)')*

= $0.75^2 + 0.75^2$

= *1.125)*

=1.06

The **sd** *for event 5 there are two possible routes: A* + C + D *and B* + E*, calculate both, then take the longest route*

sdforA + C + *D* = $0.75^2 + 0.75^2 + 0.5^2$

= *1.375)*

= *1.17*

sdforB + E = $0.25^2 + 0.33^2$

= *0.1714)*

= *0.41*

The biggest* is *1.17

The te and s values calculated above are depicted in the figure below:

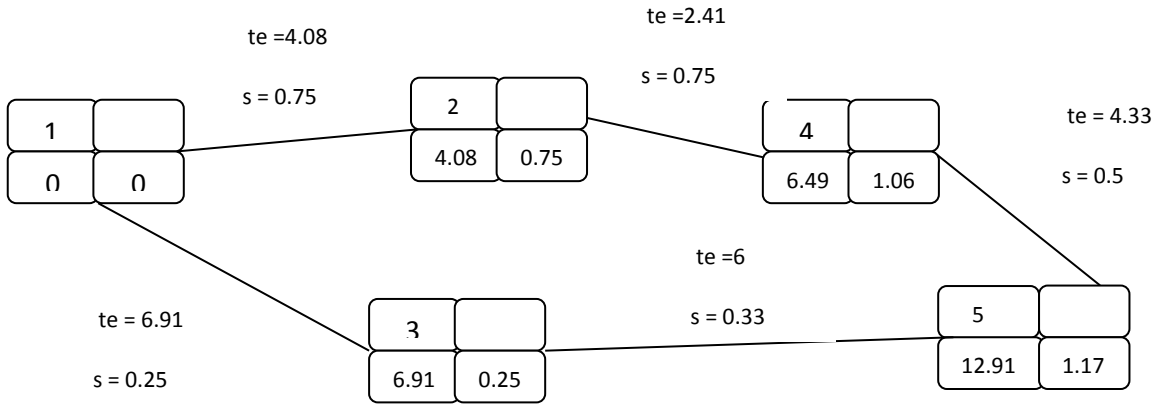


Diagram 1: The Pert network

(1 mark for each value on the diagram = I marks, remember target date of *15 weeks is given)*

In the table below find a summary of the calculations:

	Optimistic (a)	Most Likely (m)	Pessimistic (b)	Expected (te)	Standard Deviation (s)
A	2	4	6.50	4.08	0.75
B	6	7	7.50	6.91	0.25
C	1	2	5.50	2.41	0.75
D	2.50	4.50	5.50	4.33	0.5
E	5	6	7	6	0.33

Table for Pert network calculations

5.2 Based on your calculation of (te), what is the project duration? State it in weeks.

Answer

The project duration is 12.91 weeks

5.3 Calculate the Z value on the last event. (3)

Use the formula below to calculate the Z value for last activity:

Answer

$$Z = \frac{T - te}{s}$$

$$Z = (10-12.91/1.17)$$

$$= -2.48$$

5.4 According to figure 7.8 (p.181) in your textbook, what is the probability of not meeting the target date? (2)

The probability of not meeting the target date is approximately 97% or 98%. This value was derived from figure 7.8, using the Z value of -2.48 (that was calculated above) as input on the X- axis. The Probability Value can then be read from the Y-axis.