Software Project Management

INF3708

Semester 1

School of Computing

IMPORTANT INFORMATION:

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

Solution for assignment 03 Questions

Total mark **[114]**

QUESTION 1 **[18 Marks]**

1.1 Distinguish between Expert judgement and Analogy as part of the software effort estimation techniques discussed in your textbook. (4)

Answer

Expert judgement is technique that is based on asking estimate effort from someone who is knowledgeable about either the application or the development environment.
Expert judgement is normally used when estimating the effort needed to change an existing piece of software.
It is an estimate perform by someone who is already familiar with the software.

While

Analogy is an estimating technique that is based on case reasoning.
The estimator identifies completed projects (source cases) with similar characteristics to the new project (the new cases) and the effort recorded for the matching source case is then used as a base estimate for the target.
Analogy is a good approach where you have information about some previous projects but not enough to draw generalized conclusion about what might be useful drivers or typical productivity rates.

1.2 The table below contain details about previously developed software projects/modules.

Project/ module	**inputs**	**entity types accessed**	**outputs**	**days**	**euclidean distance from new**
a	1	2	10	2.6	
b	10	2	1	3.9	
c	5	1	1	1.83	
d	2	3	11	3.5	
e	1	3	20	4.3	
new	7	1	7		

Table 1: for question 1

A new software project/module has 7 inputs, 1 entity type access and 7 outputs.

With the above information, answer the following questions:

a. **1.2a.** What is the formula for calculating Euclidean distance? (2)

Answer

Euclidean distance is calculated as:

Distance = square-root of ((target_parameter$_1$ – source_parameter$_1$)^2 + target_parameter$_n$ – source_parameter$_n$)^2)

1.2b. Calculate the euclidean distance for all the projects/modules from the new (10)

module	inputs	entity types accessed	outputs	days	euclidean distance from new
a	1	2	10	2.6	6.70
b	10	2	1	3.9	6.70
c	5	1	1	1.83	6.32
d	2	3	11	3.5	6.40
e	1	3	20	4.3	14.31
new	7	1	7		

1.2c. Which of the projects/modules A to E is the closest analogy in terms of Euclidean distance? (2)

Answer

Module C would appear to provide the best analogy as it is at the least Euclidean distance from the new module.

QUESTION 2 [10 Marks]

Controlling changes during prototyping has been identified as major problem with prototyping. Discuss the possible approach to address this according to Hughes & Cotterll (2009).

Answer

See page 88 before section 4.10

An approach to prototyping is to categorise changes as belonging to one of three types:

Cosmetic (often about 35% of change): these are changes to the layout of the screens or reports and they are normally implemented and recorded.

Local (often about 60%): these change the way screen or report is processed but do not affect other parts of the system. They are implemented, recorded, backed-up so that they can be removed at a later stage if necessary, and finally inspected retrospectively.

Global (about 5% change): these are changes that affect more than one part of the processing. All the changes here have to be the subject of a design review before they can be implemented.

Question 3 [19 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. (4)

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"
(1 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. Using Boehm's equation, calculations and identify which year each system will be completed. Which system can be completed in three years? N:B show all your calculations. (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 (52 marks)

4.1 Using the information in table 2 below

Activity	Duration (Working weeks)	Precedents
A	2	None
B	3	None
C	4	A
D	3	B,A
E	8	D,C
F	3	C
G	2	E
H	3	F,G

Table 2 for Question 4

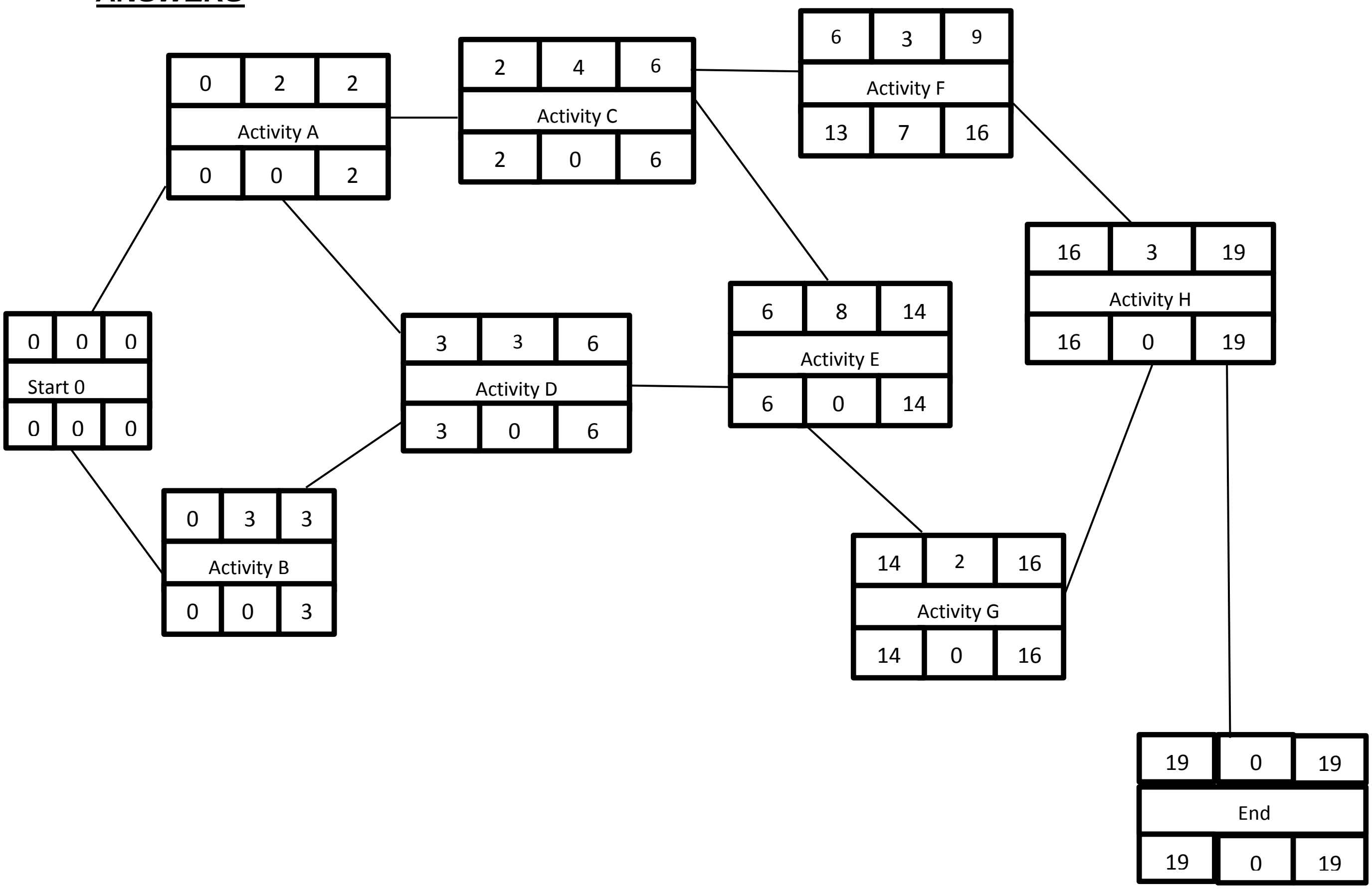
4.1.1 Consider the following list of tasks with dependencies and estimated durations reflected in the table, do the following: [20]

a) Draw a network diagram **(activity-on-node)** (8)

b) Calculate **all** the node values on the nodes forward pass (earliest date) and backward pass (latest date). Note: please use the notation example in your textbook. (8)

c) What is the slack (float) time associated with the non-critical activity/ies (4)

ANSWERS



4.1.2 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. [10]

a) Write down the critical path using the letters of the tasks. Calculate and write down the duration of the critical path. (6)

b) Identify all the remaining other paths and Calculate the duration. (2)

c) What is the project duration? (2)

ANSWER

This diagram has three critical paths out of all its paths

The critical path 1: A-C-E-G-H
2+4+8+2+3 = 19

Critical path 2: A-D-E-G-H
2+3+8+2+3 = 18

Critical path 3: B-D-E-G-H
3+3+8+2+3 = 19

The other remaining path is : A-C-F-H
2+4+3+3 = 12

The project duration is 19 weeks

4.2 Using your own words explain what dummy activities are. Why are they needed and possible reasons for using them. (4)

Answer

Dummy activities are activities with zero duration shown as dotted lines on the network diagram. These activities makes no use of resources. Because inn activity-on-arrow, you cannot have two activities starting and finishing at the same time, dummy activities are needed.

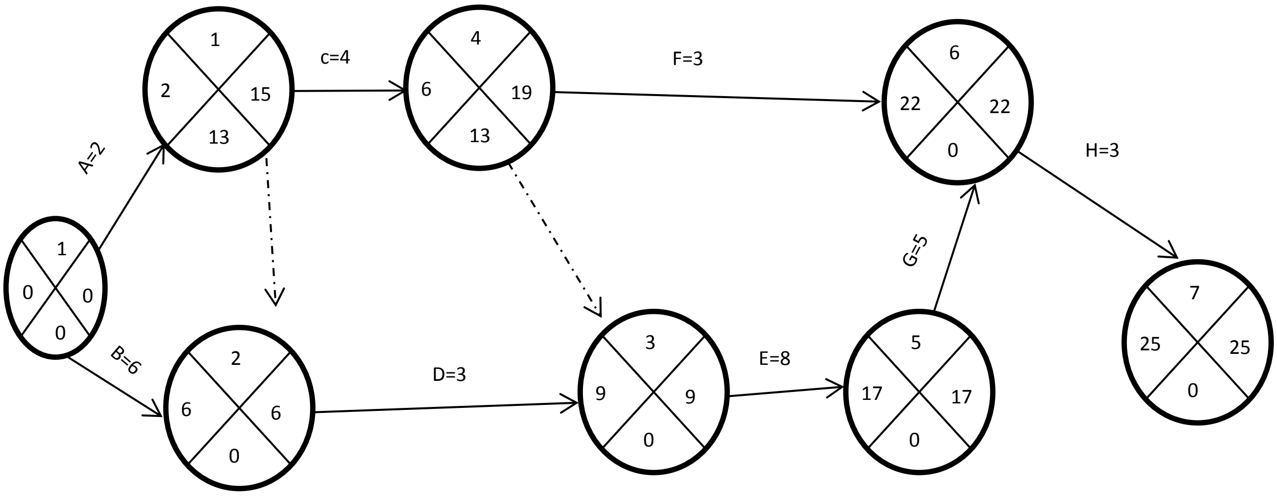
You need a dummy when two activities share the same start and end nodes. Dummy makes it easier to distinguish the activity end-points. Stating it differently, one could say that a dummy is needed when two activities depends on activity in common but they also have an activity they do not have in common. Dummies are also use to help with the layout of network diagram.

One possible instance to use dummy is where two or more activities would start and end at the same nodes. Another instance is where two or more activities depends on the finishing of a common activity but also depends on activities that are not in common finishing.

4.2.1. Assuming the duration of activity B and G in table 2, changes to 6 and 5 respectively. Draw a new network diagram (activity-on-arrow) to accommodate these changes. Clearly demonstrate the dummy activities

Calculate the forward and backward pass (10)

Answer



4.2.2 Explain in detail why dummies are used in the network diagram drawn in question 4.2.1. (4)

Answer

The first dummy is used in the above diagram because, activity C only depends on activity A while activity D depends on both B and A, therefore a dummy is needed.

The second dummy is used to show that activity F depends solely on activity C whereas activity E depends on both D and C.

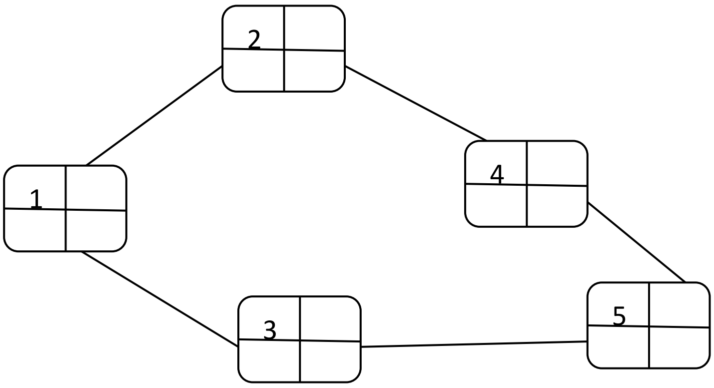
4.2.3 What effects does the change in activity B and G have on the project duration? Did you notice any other change on the diagram? What is the change? (4)

Answer

The effect is that the duration of the project changed from 19 to 25. Another change is that the slack of node 1 and 4 changed from 7 to 13.

QUESTION 5 [15]

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. (2.5)

Calculate Standard Deviation (s) for all the activities (2.5)

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? (1)

<u>Answer for question 5.1 to 5.4</u>

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. (2.5)

Calculate the te values of each activity as follows:

*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 (2.5)

Caculate the **s** values of each activity as follows:

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:*

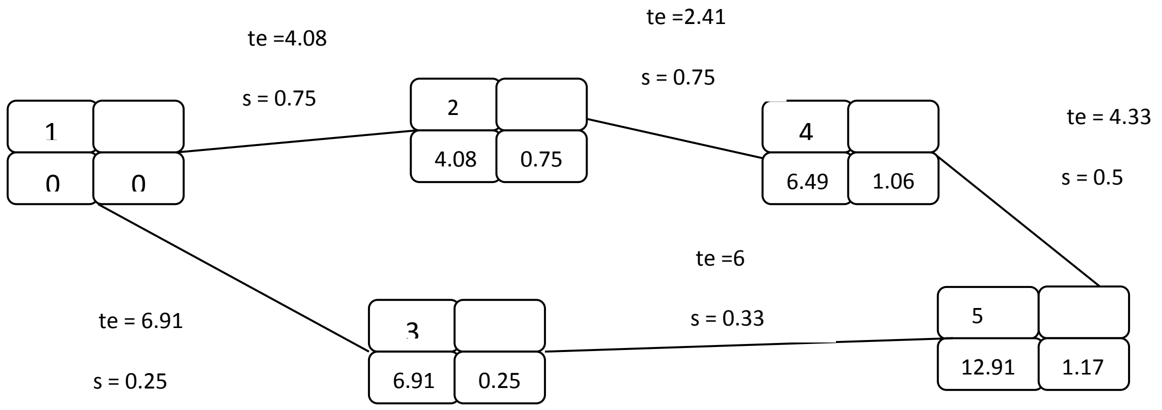


Diagram 1: The Pert network

(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. (2)

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? (1)

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.