Questions on Chapter 6 - Activity Planning

QUESTION 1 **[34]**

1.1 Consider the following list of tasks with dependencies and estimated durations reflected in table 1. Draw a CPM network (activity-on-arrow diagram) to illustrate the interaction of activities. Include all the values in the nodes. (12)

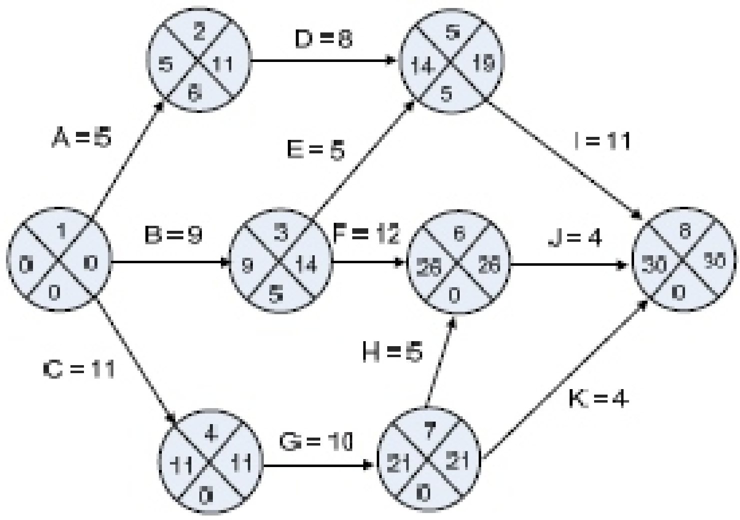
Task	Precedents	Duration (weeks)
A	None	5
B	None	9
C	None	11
D	A	8
E	B	5
F	B	12
G	C	10
H	G	5
I	D, E	11
J	F, H	4
K	G	4

Table 1 for Question 1.1

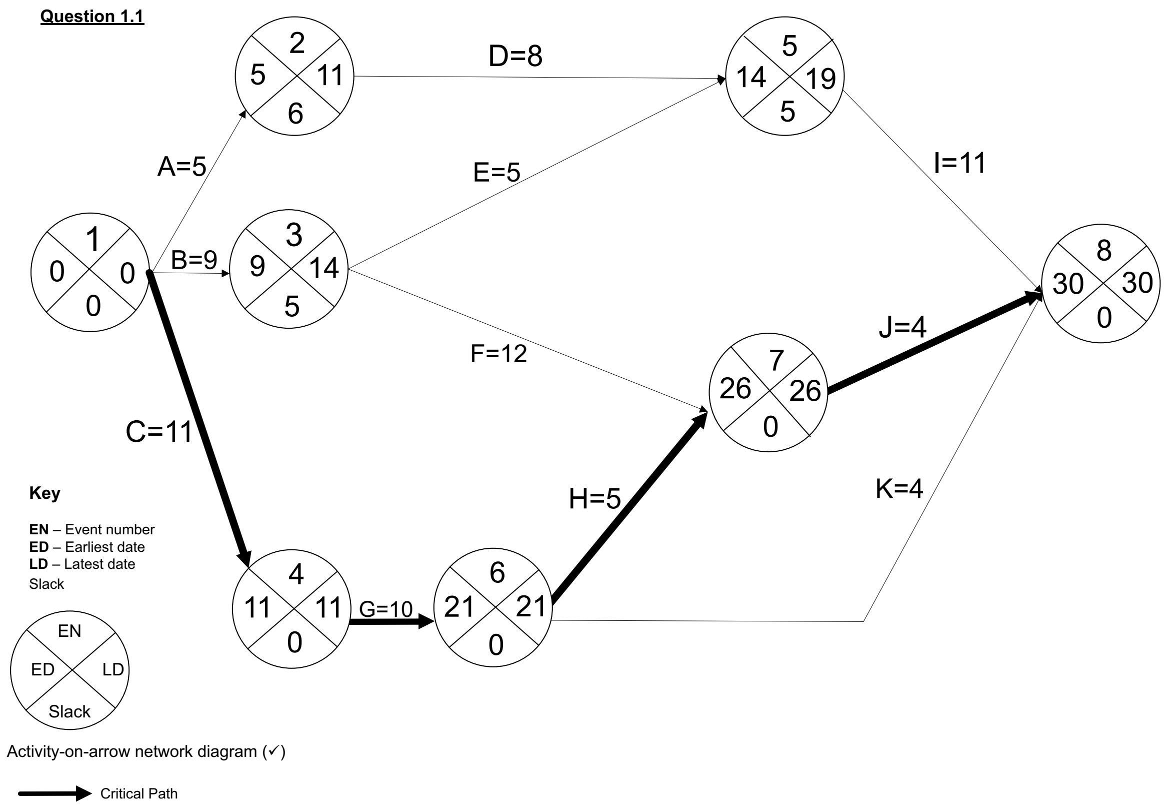
Answer:

2 marks for each intermediate node with correct values = 12
Subtract ½ mark for every wrong start and end node (only if all the intermediate nodes are correct).

Answer:



OR Below for indicated critical path on the diagram, and details:



1.2 Write down the critical path(s) using the letters of the tasks and calculate and write down the duration of the project. How many paths are there in total? Identify them all and write them down. (3)

Answer:

Critical path (= longest path and with a slack of zero) C-G-H-J = 30 weeks ½ mark.

All paths are:

Path	Duration	
A-D-I	5 + 8 + 11 = 24	½ mark
B-E-I	9 + 5 + 11 = 25	½ mark
B-F-J	9 + 12 + 4 = 25	½ mark
C-G-H-J (Critical path)	**11 + 10 + 5 + 4 = 30**	½ mark
C-G-K	11 + 10 + 4 = 25	½ mark

1.3 What will the effect on the project be if the duration of activity A changes to 12 weeks? (1)

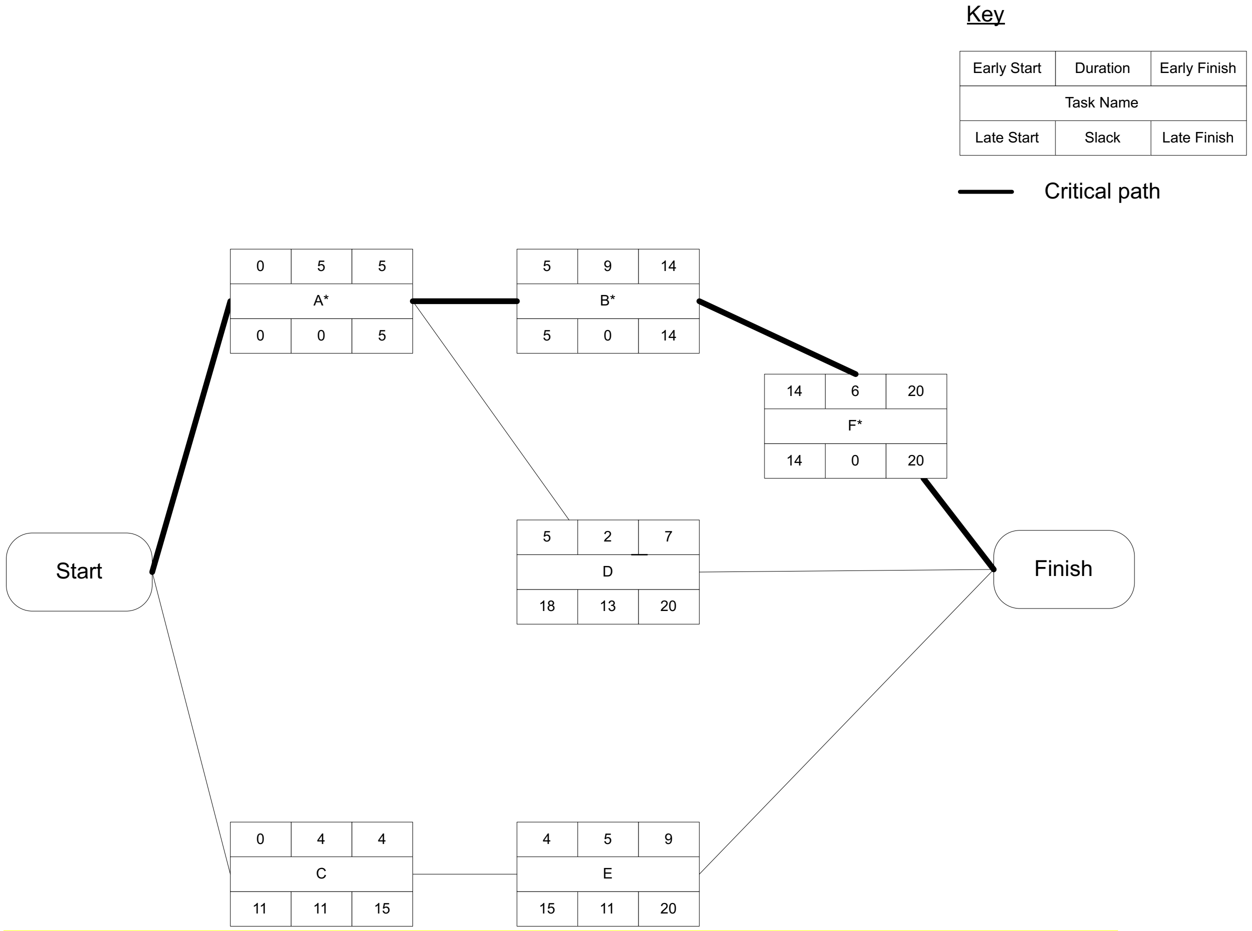
Answer: Critical path = A-D-I and duration = 31 weeks (1 mark)

1.4 Consider the following list of tasks with dependencies and estimated durations reflected in table 2. Draw the activity-on-node network (precedence network) diagram for the tasks as given in table 2. Indicate **all** the values on the nodes. Indicate the critical path with an * on each task in the path. (13)

Task	Precedents	Duration (weeks)
A	None	5
B	A	9
C	None	4
D	A	2
E	C	5
F	B	6

Table 2 for Question 1.4

Answer:



[2 marks for each node with all information, (2*6=12), one mark for start and end node, total = 13]

1.5 Calculate the earliest start time, earliest finish, latest start time, latest finish and total float of the tasks for the activity-on-node network (precedence network) diagram drawn in Question 1.4. Give your answer in table format. (5)

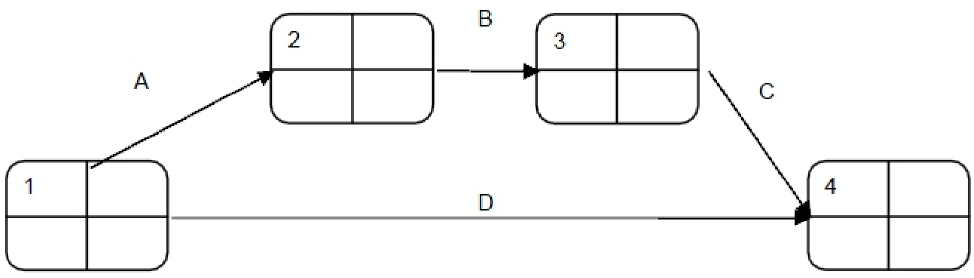
Answer: [Maximum 1 mark were given for each column if all the values are correct, with ½ mark subtracted for each incorrect value in a column to a maximum of 1 mark.]

Task	Duration (weeks)	Earliest Start	Earliest Finish	Latest Start	Latest Finish	Float
A	5	0	5	0	5	0
B	9	5	14	5	14	0
C	4	0	4	11	15	11
D	2	5	7	18	20	13
E	5	4	9	15	20	11
F	6	14	20	14	20	0

Questions on Chapter 7 - Risk Management

QUESTION 2 **[26]**

In the PERT network illustrated in the figure below, the target date for the completion of the project is 11 weeks.



Activity	Optimistic (a)	Most Likely (m)	Pessimistic (b)	Expected (te)	Standard Deviation (s)
A	3	4	5		
B	1	2	3		
C	2	3	4		
D	4	5	6		

Table for Question 2

Use the table above to calculate the following:

2.1 Calculate the Expected (t_e) values and Standard Deviation (s) for all the activities and the events and indicate all the (t_e) and (s) values on the diagram. (13)

Answer:

Use the following formula for t_e values:

$t_e = (a + 4m + b)/6$

t_e value for activity A: $\frac{3 + 4(4) + 5}{6} = 24/6 = 4$

t_e value for activity B: $\frac{1 + 4(2) + 3}{6} = 12/6 = 2$

t_e value for activity C: $\frac{2 + 4(3) + 4}{6} = 18/6 = 3$

t_e value for activity D: $\frac{4 + 4(5) + 6}{6} = 30/6 = 5$

Use the following formula for s values:

S = (b-a)/6

s value for activity A: $\frac{5-3}{6} = 2/6 = 1/3 = 0.33$

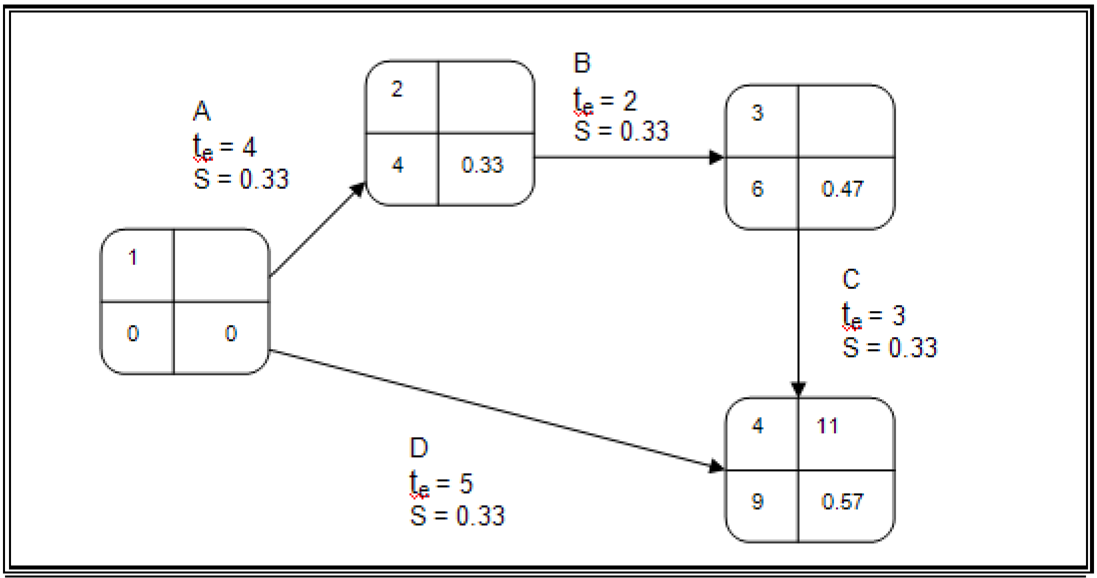
s value for activity B: $\frac{3-1}{6} = 2/6 = 1/3 = 0.33$

s value for activity C: $\frac{4-2}{6} = 2/6 = 1/3 = 0.33$

s value for activity D: $\frac{6-4}{6} = 2/6 = 1/3 = 0.33$

Answer to question 2.1 can be found in the table and diagram below.

Activity	Optimistic (a)	Most Likely (m)	Pessimistic (b)	Expected (t_e)	Standard Deviation (s)
A	3	4	5	4 (1mark)	0.33 (1mark)
B	1	2	3	2 (1mark)	0.33 (1mark)
C	2	3	4	3 (1mark)	0.33 (1mark)
D	4	5	6	5 (1mark)	0.33 (1mark)



1 mark @ node except the last event (event 4) node which is 2 marks

2.2 Calculate the Z value of the last event. (3)

Note: Standard deviation for the project events can be calculated by carrying out a forward pass using the activity standard deviations in a manner similar to that used with expected duration. There is, however, one small difference – to add two standard deviations we must add their sqaures and then find the square root of the sum.

Standard deviation of event 4 is calculated as follows:

Two paths are possible ie A-B-C or D.

The standard deviation selected will be the greater of the standard deviations of activities

Standard deviation of A-B-C:

$S = \sqrt{A+B+C} = \sqrt{(0.33^2 + 0.33^2 + 0.33^2)}$

$= 0.57$

or the standard deviation of activity D = 0.33

Therefore, the standard deviation for event 4 is 0.57. 1 mark

$Z = (T - t_e)/S$
$= (11 - 9)/0.57$ 1 mark
$= 2/0.57$
$= 3.51$ 1 mark

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

Answer:

Since the Z value is 3.51, the probability of not meeting the target date is 0 (zero). Refer to figure 7.8 in your textbook. 2 marks

Some definitions for terms used above:

PERT (Program Evaluation Review Technique) network diagram is used to model a project‟s activies and their relationships as a network. It was developed to take account of the uncertainty surrounding estimates of task durations.

It is very similar to the CPM (Critical Path Method) technique but, instead of using a single estimate for the duration of each task, PERT requires three estimates

Most likely time: the time we would expect the task to take under nomal circumstances. Denoted by m.
Optimistic time: the shortest time in which we would expect to complete the activity, barring outright miracles. Denoted by a.
Pessimistic time: the worst possible time allowing for all reasonable evetualities but excluding „acts of God and warfare‟. Denoted by b.

PERT then combine these three estimates to form a single **expected duration**, t_e, using the formula:
$\mathbf{t_e} = (a + 4m + b)/6$

Standard deviation

We also calculate standard deviation for each activity. It is used to calculate the quantitative measure of the degree of uncertainty of an activity duration. The formula for standard deviation is based on the rationale that there are approximately six standard deviations between the extreme possibilities of any statistical distribution. The formula is as follows:

$S = (b - a)/6$

Z value

The Z value is calculated for each node that has a target date. It is equivalent to the number of standard deviations between the node"s expected and target dates. It is calculated using the formula:

$Z = (T - t_e)/S$

Where t_e is the expected date and T the target date. The Z value may be converted to the **probability of not meeting the target date** by using the graph in figure 7.8 of Hughes and Cotterell.

2.4 Briefly discuss a framework for dealing with risk. (8)

Answer:

Students are referred to the textbook p. 166 section 7.4

2 marks will be allocated for naming and discussing each of the following basic steps:

- ✓ Risk identification; 2 marks
- ✓ Risk analysis and prioritization; 2 marks
- ✓ Risk planning; 2 marks
- ✓ Risk monitoring. 2 marks

Study pages 166 to 176 for detail on each of these steps.

Possible discussion:

P166 – p176 describes the framework dealing with risk. The steps identified include risk identification; risk analysis and prioritization; risk planning; risk monitoring.

1. Risk Identification: Involves the use of checklists and brainstorming. A checklist is an already developed list of risks likely to occur in a software development project, as well as countermeasures that can be taken to reduce the risk. Organizations may have their own organizational risk checklist. Table 7.1, p167 gives an example of such a checklist.

   This is discussed by a group of project stakeholders once there is a preliminary project plan. The checklist as well as knowledge and experience of the participants are used to identify problems that may occur. This collaboration is important in giving a sense of ownership of the project to stakeholders.

It is recommended that on review of completed projects, any problems identified and the steps taken to avoid or resolve them be documented. These could in some cases be added to the organizational risk checklist.

2. Risk Analysis and Prioritization: Once the risks have been identified they need to be distinguished in terms of which are most likely and how damaging exposure to the risk would be. Risk exposure formula is a way of estimating potential damage the risk can cause. Risk exposure may be indicated as a monitory or duration value (p168-169).

   It is important that planners prioritize risks, and give focus to highest risks, and the potential impact the risk may have. Probability impact matrix (p171) represents the risks according to the probability and impact.

3. Risk Planning (p172 – 173): Once the risks are identified and prioritized the next step is to decide on how to deal with each of them. This includes

   a. Risk acceptance – do nothing, particularly if the anticipated damage would be less than the cost of trying to reduce the likely occurrence of the risk.

   b. Risk voidance – take a decision of whether to continue or change direction based on the level of the risk. For example an alternative may be found instead of developing the software.

   c. Risk reduction and mitigation – when a decision has been made to continue, precautions to reduce the probability of the risk may be taken. Risk reduction involves reducing the likelihood of the risk occurring, while risk mitigation is related to contingency planning, and involves reducing the impact of the risk in the event that it occurs.

   d. Risk transfer – In this instance the organization may choose to move the risk to someone else other than itself, for example through outsourcing. This has the potential of increasing the cost because the outsourced organization may want to cover the risk. Competition may however keep prices down.

4. Risk Monitoring: This involves the contingency planning (p174) and drafting and maintaining a risk register (Fig 7.5 p. 175). A contingency plan is a planned action to be carried out if the particular risk materializes. There are costs associated with taking the contingency measure. Most important is that the contingency measure should be cost-effective. The cost-effectiveness of a risk reduction action can be calculated using the risk reduction leverage (RRL) formula (p174). Example of a risk register is on p175 (Fig 7.5).

   The risk register should be reviewed and amended as part of the project control lifecycle. Risk identification, analysis and prioritizing and planning would also be probably repeated throughout the project lifecycle.

Note: the question is “Discuss” a framework. This requires that you deliberate or examine the framework. This is more than simply describing or just outlining. The expectation is that you will describe as well as deliberate (discuss) the framework.

Questions on chapter 5 – Software effort estimation

QUESTION 3 **[20]**

3.1 Provide the equation and identify the variables in Boehm‟s equation for calculating effort in the use of the COCOMO model. (4)

Answer:

Boehm‟s equation for calculating effort in the use of the COCOMO model

Boehm's equation: Formula:

Effort = c* (size)^{*k} (1 mark)

Effort measured in person months – 152 working hours (1 mark)

Size is measured in kdsi – thousands of delivered source code (1 mark)

c and k are constants (1 mark)

Where effort is measured in pm, or the number of "person-months" consisting of units of 152 working hours, size is measured in kdsi, thousands of delivered source code instructions, and c and k are constants.

The first step was to derive an estimate of the system size in terms of *kdsi*. The constants, *c* and *k*, depended on whether the system could be classified, in Boehm‟s terms, as "organic", "semi-detached" or "embedded". These related to the technical nature of the system and the development environment. *c* and *k* are constant values derived from the table to be read off.

3.2 Five systems with the following estimated lines of code were identified. Identify which can be completed in three years. (16)

System	Lines of code	System type
A	10568	Embedded mode
B	12572	Semi-detached mode
C	16342	Organic mode
D	8553	Organic
E	7014	Semi-detached

Table for Question 3: System details

Answer:

The first step is to derive an estimate of the system size (as depicted by the lines of code) in terms of kdsi. The constants c and k depend on whether the system is classified in Boehm"s terms as "organic", "semi-detached" or "embedded" (p120-121). These relate to the technical nature of the system and the development environment and are obtained from the given table below:

System type	**c**	**k**
Organic	2.4	1.05
Semi-detached	3.0	1.12
Embedded	3.6	1.20

A	$=3.6*((10568/1000)^{1.2})$	=	60.97	person months / 12 = years:	5.0808333	5.08 years
B	$=3.0*((12572/1000)^{1.12})$	=	51.1	person months / 12 = years:	4.175	4.26 years
C	$=2.4*((16342/1000)^{1.05})$	=	45.1	person months / 12 = years:	3.7583333	3.76 years
D	$=2.4*((8553/1000)^{1.05})$	=	22.85	person months / 12 = years:	1.9041667	1.90 years
E	$=3.0*((7014/1000)^{1.12})$	=	26.58	person months / 12 = years:	2.215	2.22 years
	5 marks, i.e., 1mk@row		5 marks, i.e., 1mk@row			5 marks, i.e., 1mk@row

NB/: Remember to solve the bracket, and then power k before multiplying by c.

Therefore, both systems **D** and **E** can be completed in three years. 1 mark

Questions on chapter 8 – Resource allocation

QUESTION 4 **[15]**

4.1 The staff cost of the Phumzani Project is shown below. Nomsa is the project leader of the Phumzani project and will spend 10 extra days on the project to plan and carry out the post project review. The project is scheduled to be finished in 26 days. An amount of R350 per day is charged by the Phumzani team for overhead costs. Busi will work on the project every day, Samuel and Amy will work only half of the days and Juan will work only 10 days

Staff member	**Daily cost**
Nomsa	R400
Samuel	R200
Juan	R300

Busi	R400
Amy	R300

Table for Question 4

Calculate the total cost for the Phumzani project. **[14]**

Answer

To calculate the total cost of the Phumzani project we need to refer to the information for each individual. For Samuel and Amy who works only half of the total number of day, we will use 13 as the value in our calculations. Cost = daily cost * days required

Staff member	Daily cost	Days required	Cost	
Nomsa	R400	26 +10 = 36	R 14,400	2 marks
Samuel	R200	26 / 2 =13	R 2,600	2 marks
Juan	R300	10	R 3,000	2 marks
Busi	R400	26	R 10,400	2 marks
Amy	R300	26 / 2 =13	R 3,900	2 marks
Overhead costs**	R350	26	R 9,100	2 marks
Total			**R 43,400**	2 marks

Table for solution to question 4.1: Total cost for Phumzani project

****Note:*** The overhead cost per day is very important to include in the calculation of the cost of the entire project. The overhead cost is calculated for the number of days for which the project is scheduled and not for additional days that some staff members may work. This cost can easily be overlooked with great influence on the final cost. In this scenario the overhead cost was only R 9100 but in bigger projects this cost can grow exponentially to have a staggering influence on the total cost of the project.

4.2 Identify 1 other type of cost that could also be relevant, and that were not taken into account in 3.1. **[1]**

Answer: Discussion

(This question will be judged on merit)
Other possible types of costs to be considered:

- Usage charges (textbook section 8.9 – page 206 mentions 3 types of costs of which

Staffing costs and overheads are discussed already in the problem, leaving usage charges to be included.)

- Training costs
- Equipment costs – any additional equipment that has to be bought for the project.
- Risk costs – for example costs involved if for some reason the project cannot be completed according to the planned time.
- Additional cost could be involved if additional staff has to be appointed to be able to meet the target date. If this is not done costs of delayed delivery might be involved. (refer to section 8.6)
- Team building costs.
- Charge for computer time
- Rental of premises
- Office equipment (phones, faxes)
- Stationary
- Services (Telkom)

Any of the above (1 Mark)

QUESTION 5 **[5]**

Explain in detail what a project manager can do when a project will not meet the target date. What should he NOT do?

Answer:

Section 9.8 Page 229-232

- Renegotiate due date / cost with client
- Revisit requirements (MOSCOW)
- Ensure effective resources are on critical path (re-allocation of resources)
- Schedule overtime
- Re-look tasks start dates to maybe start sooner
- Shorten critical path

Three marks for any three (DOs) points explained

Do Not

- add new resources
- compensate on quality
- skip steps in the SDLC
- give in on testing (quality)
- Be careful to shorten critical path and then create another critical path

Two marks for any two (DON'Ts) points explained