MAY / JUNE 2016 EXAM REVISION 1

SOLUTIONS

SOLUTION to QUESTION 1:

1. Calculate the net profit of each project. (3)

	PROJECT 1	PROJECT 2	PROJECT 3
NET PROFIT	-R195 000 + R255 000 = +R60 000 ✓	-R160 000 + R230 000 = +R70 000 ✓	-R295 000 + R460 000 = +R165 000 ✓

2. Based on your calculation of the Net Profit, identify which project you would select to develop. Motivate your answer. (2)

Project 3. ✓ - as it has the highest net profit, R165 000. ✓

3. Calculate of Return on Investment (ROI) of each of the projects given in the table. (3)

	PROJECT 1	PROJECT 2	PROJECT 3
AVERAGE ANNUAL PROFIT	R60 000 ÷ 6 = R10 000	R70 000 ÷ 6 = R11 667	R165 000 ÷ 6 = R27 500
ROI	(10 000 ÷ 195 000) x 100 = 5.13% ✓	(11 667 ÷ 160 000) x 100 = 7.29% ✓	(27 500 ÷ 295 000) x 100 = 9.32% ✓

4. Based on your calculation of the ROI, identify which project you would select to develop. (2)

Project 3 ✓ has the highest ROI, 9.32% and would thus be selected for development ✓

SOLUTION to QUESTION 2:

1. Calculate the net profit of each project. (3)

	PROJECT 1	PROJECT 2	PROJECT 3
NET PROFIT	-R180 000 + R240 000 = +R60 000 ✓	-R160 000 + R225 000 = +R65 000 ✓	-R280 000 + R450 000 = +R170 000 ✓

2. Based on your calculation of the Net Profit, identify which project you would select to develop. Motivate your answer. (2)

Project 3. ✓ - as it has the highest net profit, R170 000. ✓

3. Calculate of Return on Investment (ROI) of each of the projects given in the table. (6)

	PROJECT 1	PROJECT 2	PROJECT 3
AVERAGE ANNUAL PROFIT	R60 000 ÷ 6 = R10 000	R65 000 ÷ 6 = R10 833	R170 000 ÷ 6 = R28 333
ROI	(10 000 ÷ 180 000) x 100 = 5.56% ✓	(10 833 ÷ 160 000) x 100 = 6.77% ✓	(28 333 ÷ 280 000) x 100 = 10.12% ✓

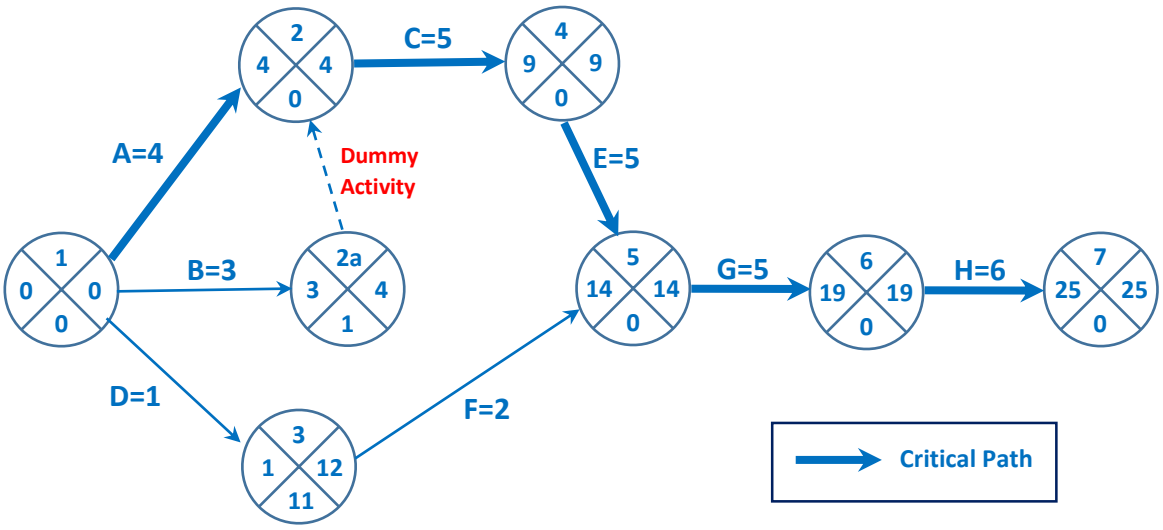
4. Based on your calculation of the ROI, identify which project you would select to develop. (2)

Project 3 ✓ has the highest ROI, 10.12% and would thus be selected for development ✓

SOLUTION to QUESTION 3:

Task	Precedents	Duration (weeks)
A	None	4
B	None	3
C	A, B	5
D	None	1
E	C	5
F	D	2
G	E, F	5
H	G	6

1.



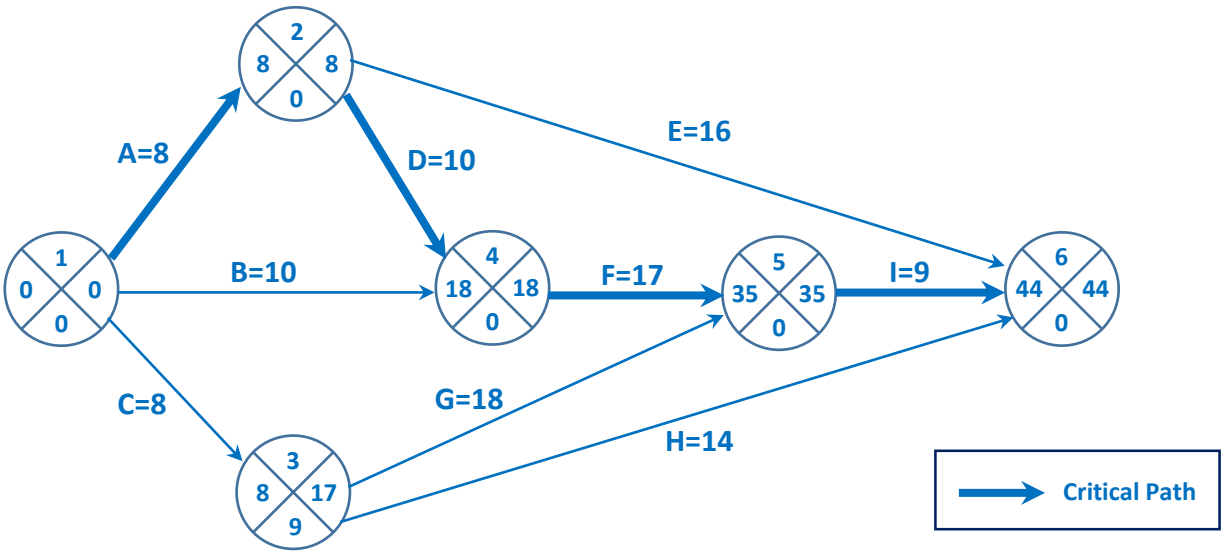
2. Critical path **(= longest path, with a slack of zero):** A-C-E-G-H = 25 weeks
There are 3 possible paths.

POSSIBLE PATHS	DURATION
A-C-E-G-H (Critical path)	**4 + 5 + 5 + 5 + 6 = 25**
B-C-E-G-H	3 + 5 + 5 + 5 + 6 = 24
D-F-G-H	1 + 2 + 5 + 6 = 14

SOLUTION to QUESTION 4:

Task	Precedents	Duration (days)
A	None	8
B	None	10
C	None	8
D	A	10
E	A	16
F	D, B	17
G	C	18
H	C	14
I	F, G	9

1.

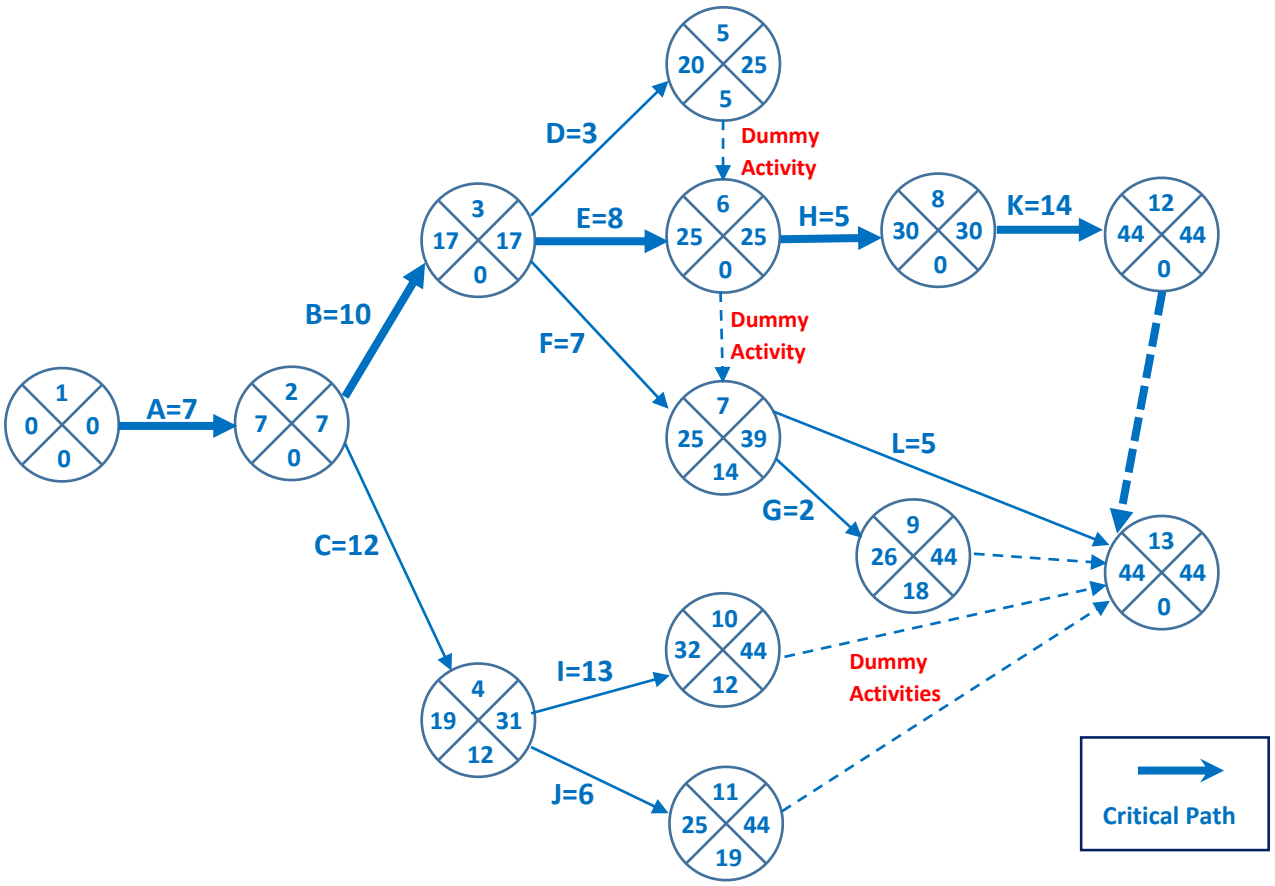


2. Critical path **(= longest path, with a slack of zero):** A-D-F-I = 44 days

SOLUTION to QUESTION 5:

Activity	Precedents	Duration (weeks)
A	None	7
B	A	10
C	A	12
D	B	3
E	B	8
F	B	7
G	F	2
H	D, E	5
I	C	13
J	C	6
K	H	14
L	E, F	5

1.



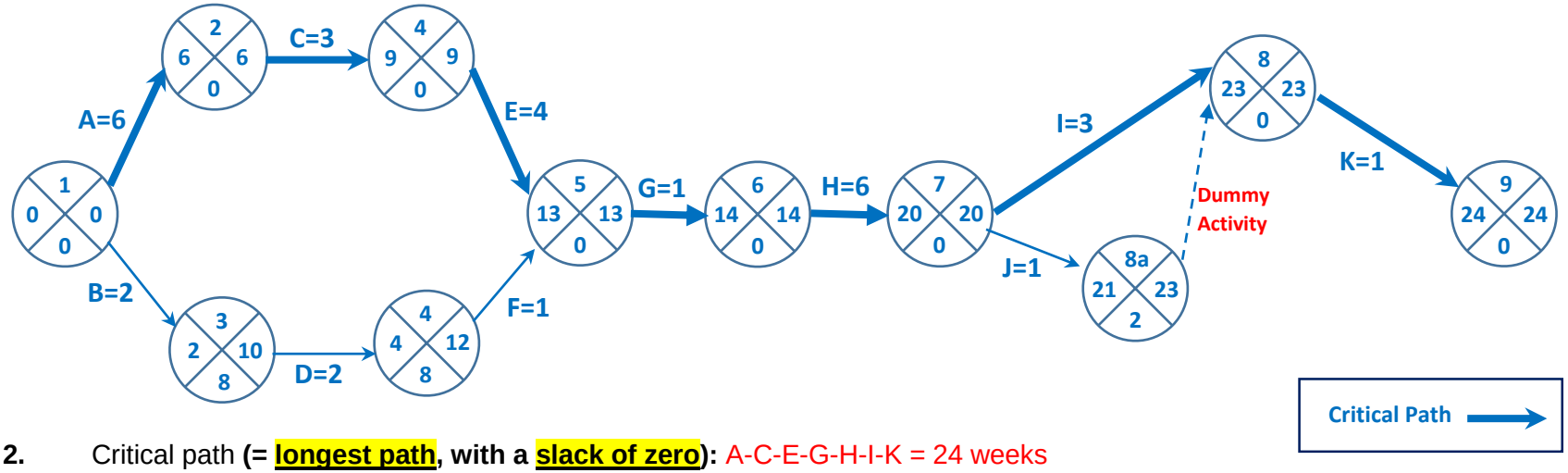
2. Critical path **(= longest path, with a slack of zero):** A-B-E-H-K = 44 weeks

SOLUTION to QUESTION 6:

Task	Precedents	Duration (weeks)
A	None	6
B	None	2
C	A	3
D	B	2
E	C	4
F	D	1
G	E, F	1
H	G	6
I	H	3
J	H	1
K	I, J	1

POSSIBLE PATHS	DURATION
A-C-E-G-H-I-K (Critical path)	6 + 3 + 4 + 1 + 6 + 3 + 1 = 24
A-C-E-G-H-J-K	6 + 3 + 4 + 1 + 6 + 1 + 1 = 22
B-D-F-G-H-I-K	2 + 2 + 1 + 1 + 6 + 3 + 1 = 16
B-D-F-G-H-J-K	2 + 2 + 1 + 1 + 6 + 1 + 1 = 14

1.

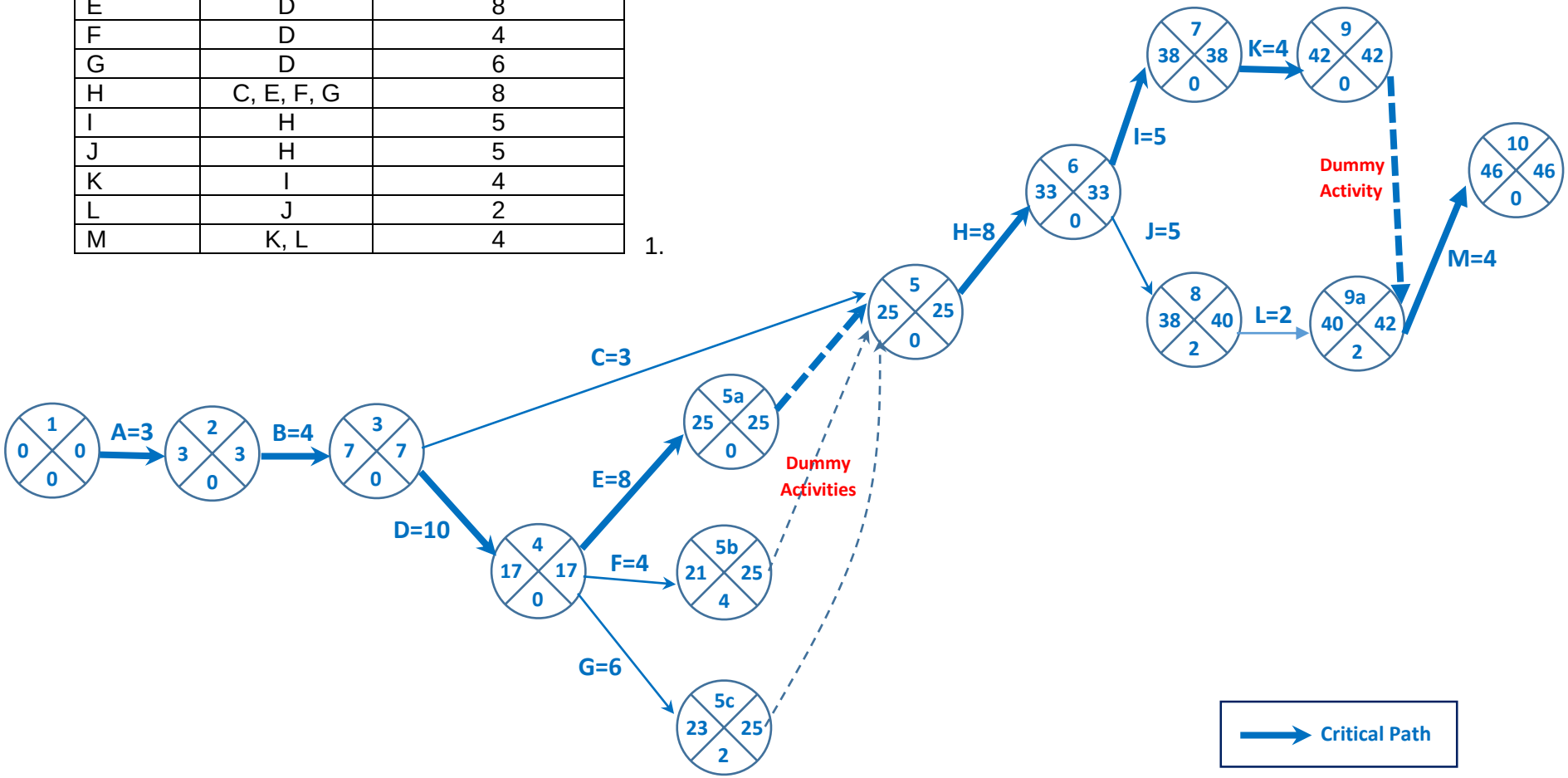


2. Critical path **(= longest path, with a slack of zero):** A-C-E-G-H-I-K = 24 weeks
There are 4 possible paths.

SOLUTION to QUESTION 7

Activity	Precedents	Duration (weeks)
A	None	3
B	A	4
C	B	3
D	B	10
E	D	8
F	D	4
G	D	6
H	C, E, F, G	8
I	H	5
J	H	5
K	I	4
L	J	2
M	K, L	4

1.



2. Critical path **(= longest path, with a slack of zero):** A-B-D-E-H-I-K-M = 46 weeks

SOLUTION to QUESTION 8

1. **Use the following formula below to calculate the te values of each activity:**

$t_e = \frac{(a+4m+b)}{6}$

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

$S = \frac{(b-a)}{6}$

	OPTIMISTIC (a)	MOST LIKELY (m)	PESSIMISTIC (b)	EXPECTED (t_e)	STANDARD DEVIATION (S)
A	2	6	10	6	1,33
B	4	5	9	5,5	0,83
C	7	8	9	8	0,33
D	2	4	12	5	1,67
E	4	6	8	6	0,67
F	3	4	11	5	1,33
G	4	8	9	7,5	0,83
H	2	2	5	2,5	0,50

- The standard deviation for Event 2 is the s of Activity A, i.e. 1.33
- The standard deviation for Event 3 is the s of Activity C, i.e. 0.33
- For the standard deviation for Event 4 there are two possible routes: A + D and B, calculate both, then take the longest route

  A + D: = ((sd of event 2)^2 + (s of Activity D)^2)
  = (1.77 + 2.79)
  = (1.33^2 + 1.67^2)
  = (4.55)
  = 2.13

  B: s = 0.83

  Thus, Standard deviation of event 4 is 2.13

- The standard deviation for Event 5 is total SD of C + F
  = ((sd of event 3)^2 + (s of Activity f)^2)
  = (0.332 + 1.332)
  = (1.88)
  = 1.37

- For the standard deviation for Event 6 there are four possible routes:
  A + E
  A + D + G
  B + G
  C + F + H
  calculate all four, then take the longest route

  A + E: = ((sd of event 2)^2 + (s of Activity E)^2)
  = (1.332 + 0.672)
  = (2.22)
  = 1.49

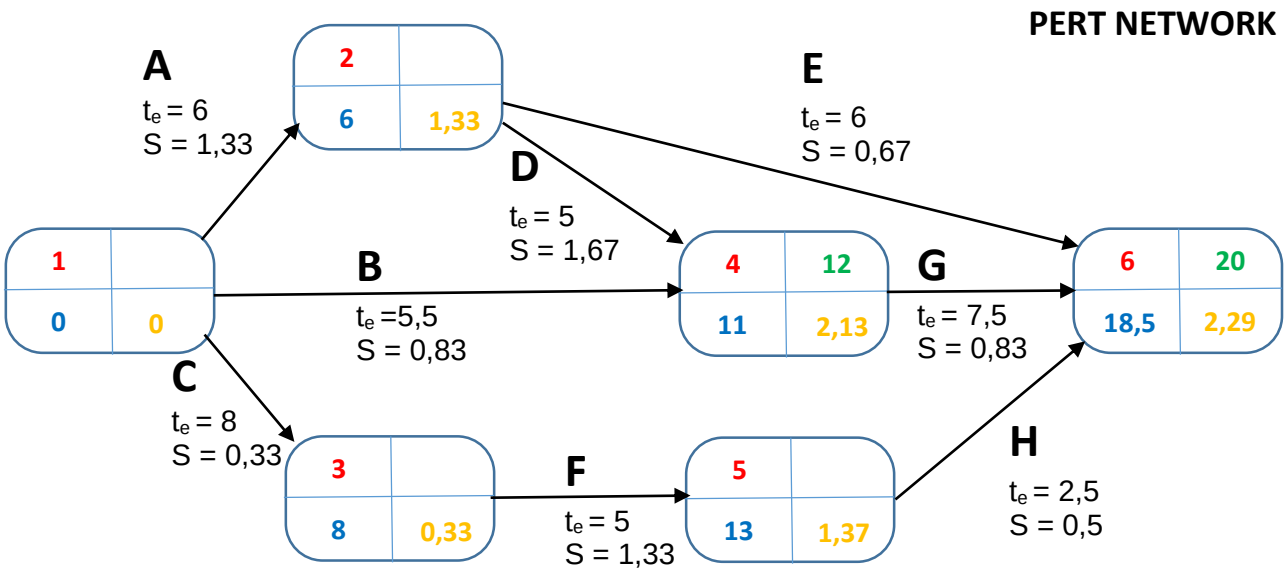
  A + D + G: = (1.332 + 1.672 +0.832)
  = (5.25)
  = 2.29

  B + G: = (0.832 + 0.832)
  = (1.38)
  = 1.17

  C + F + H: = (0.332 + 1.332 +0.52)
  = (2.13)
  = 1.46

  The largest value is 2.29, therefore sd of event 6 is 2.29

2. Draw the **PERT network** to present this information. (4)



1 mark for each expected date and sd in network = 12,
1 mark for 2 given target dates (14)

3. Calculate the **Z values** of event 4 as well as the last event.
Use the formula below to calculate the z values:

$$\mathbf{Z} = \frac{(\mathbf{T} - \mathbf{te})}{\mathbf{S}}$$

Event 4: $Z = \frac{(12 - 11)}{2{,}13} = \frac{1}{2{,}13}$

$Z = 0{,}469$

Event 6: $Z = \frac{(20 - 18{,}5)}{2{,}29} = \frac{1{,}5}{2{,}29}$

$Z = 0{,}655$ (4)

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

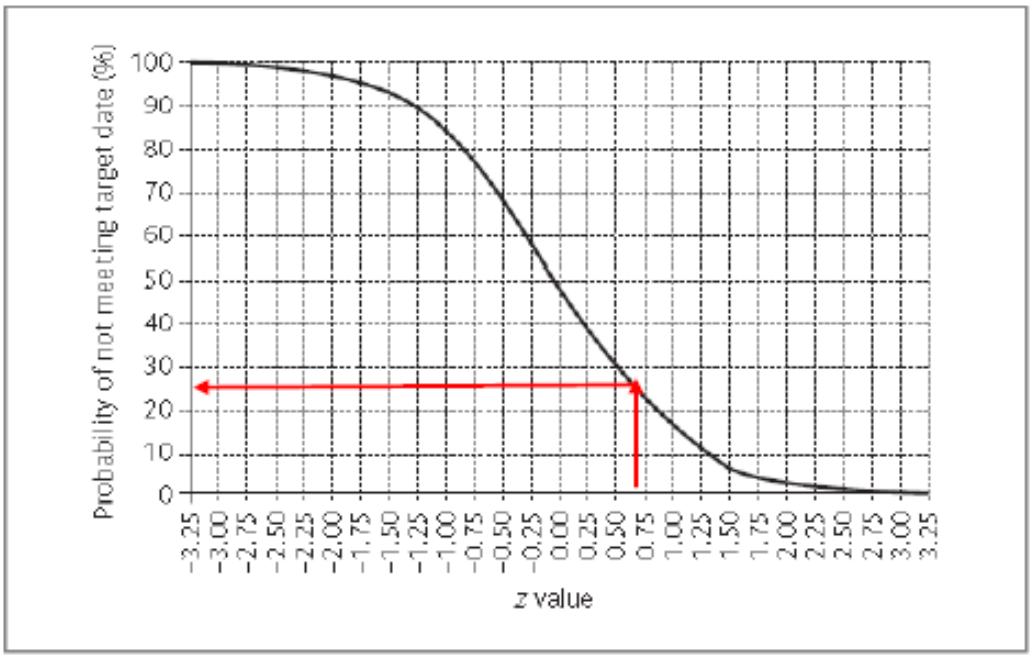


FIGURE 7.8 The probability of obtaining a value within *z* standard deviations of the mean for a normal distribution

The probability of not meeting the final target date is between 20% and 30%

SOLUTION to QUESTION 9

1. **Use the following formula below to calculate the t_e values of each activity:** (4)

$$t_e = \frac{(a+4m+b)}{6}$$

Calculating the t_e value of Activity A: t_e = [4 + 4(5) + 6] / 6 = 30 / 6 = 5
Calculating the t_e value of Activity B: t_e = [2 + 4(3) + 4] / 6 = 18 / 6 = 3
Calculating the t_e value of Activity C: t_e = [3 + 4(4) + 5] / 6 = 24 / 6 = 4
Calculating the t_e value of Activity D: t_e = [5 + 4(6) + 7] / 6 = 36 / 6 = 6

2. **Use the following formula below to calculate the s values of each activity:** (4)

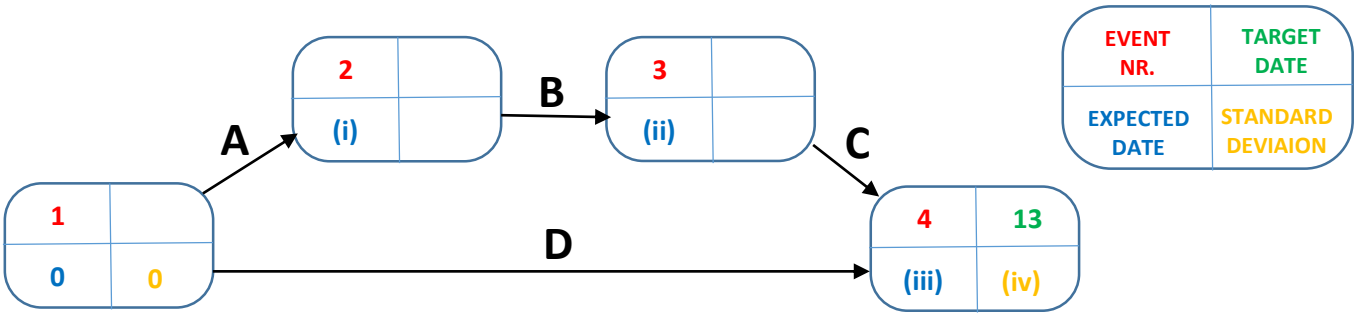
$$S = \frac{(b-a)}{6}$$

Calculating the s value of Activity A: s = [6 - 4] / 6 = 2 / 6 = 0.3
Calculating the s value of Activity B: s = [4 - 2] / 6 = 2 / 6 = 0.3
Calculating the s value of Activity C: s = [5 - 3] / 6 = 2 / 6 = 0.3
Calculating the s value of Activity D: s = [7 - 5] / 6 = 2 / 6 = 0.3

In the table below find a summary of the calculations:

	OPTIMISTIC (a)	MOST LIKELY (m)	PESSIMISTIC (b)	EXPECTED (t_e)	STANDARD DEVIATION (s)
A	4	5	6	5	0,3
B	2	3	4	3	0,3
C	3	4	5	4	0,3
D	5	6	7	6	0,3

3. The t_e and s values calculated above are depicted in the figure below:
Students were not expected to do the following diagram and table. (3)



Value for (i) = 0 + t_e (A) = 0 + 5 = 5
Value for (ii) = 5 + t_e (B) = 5 + 3 = 8
Value for (iii) = 8 + t_e (C) = 8 + 4 = 12

4. Use the calculations done in Questions 5.1, 5.2 and 5.3 above to determine the Z value for the fourth (4th) task. (7)

Use the formula below to calculate the z values:

$$Z = \frac{(T - te)}{S}$$

- The value of t_e for the last event = value of (iii) calculated above = 12.
- The **Standard deviation** of event 4 is calculated as follows:
  Two paths are possible i.e. **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 (from the table)
Therefore, the standard deviation for event 4 is 0.57. (larger of 0.33 and 0.57)

Event 4: $Z = \frac{(13 - 12)}{0{,}57} = \frac{1}{0{,}57}$

$Z = 1{,}75$

5. According to the figure, what is the probability of not meeting the target date? (2)

The probability of not meeting the target date is approximately **5%.** Any value from 4% to 6% is acceptable because it is not easy to pinpoint the precise value from the graph.