SOLUTION 1

(a) Price Function Pr

Pr = a + bx
For Pr = 3.8, x= 10200
Pr = 4.7, x = 8400

We have

$3.8 = a + 10200b$ - (1)
$4.7 = a + 8400b$ - (2)

Equation (2) - (1)

$0.9 = -1800b$
$b = -0.0005$

Subst. into (1) value of b

$3.8 = a + 10200(-0.0005)$
$3.8 = a - 5.1$
$a = 8.9$

Hence the Demand Function is
$Pr(x) = 8.9 - 0.0005x$

(b) Revenue function is given by

$R(x) = x \cdot Pr(x)$
$= x(8.9 - 0.0005x)$
$R(x) = 8.9x - 0.0005x^2$
$TC(x) = 1500 + 1.8x$ – cost function
Hence profit function PR(x)

$PR(x) = R(x) - TC(x)$
$= 8.9x - 0.0005x^2 - (1500 + 1.8x)$
$PR(x) = -0.0005x2 + 7.1x - 1500$

(c) For the Maximum Profit

$\frac{dPR}{dx} = 0$

$\frac{dPR}{dx} = -0.001x + 7.1$

$\Rightarrow -0.001x + 7.1 = 0$
$0.001x = 7.1$
$x = 7100$

when x = 7100
maximum profit is:
PR (7100) = - 0.0005 (7100) + 7.1 (7100) – 1500
= - 3.55 + 50410 – 1500
= 48906.15

(d) Price Pr is
Pr (7100) = 8.9 – 0.0005 (7100)
= 5.35

SOLUTION 2

(a) (i) Positive correlation
(ii) Negative correlation
(iii) Negative correlation
(iv) Positive correlation
(v) Negative correlation
(vi) Positive correlation
(vii) Positive correlation

(b) (ii) & (iii)

X	Y	XY	X^2	Y^2	Rx	Rxy	Ry-Rx	$(Rx-Ry)^2$
15	250	3,750	225	62500	1	3	2	4
23	1630	37,490	529	2,656,900	2	8	6	36
26	970	25,220	676	940,900	3	7	4	16
28	2190	61,320	784	4,796,100	4	9	5	25
31	410	12,710	961	688,900	5	4	-1	1
35	830	29,050	1225	168,100	6	6	0	0
37	0	0	1369	0	7	1.5	-5.5	30.28
38	550	20,900	1444	302,500	8	5	-3	9
42	0	0	1764	0	9	1.5	-7.5	56.25

$\Sigma x = 275$; $\Sigma Y = 6830$; $\Sigma xy = 190440$; $\Sigma x^2 = 8977$; $\Sigma y^2 = 8,675,000$; $\Sigma(Rx - Ry)^2 = 177.5$

$$r = \frac{n\Sigma xy - \Sigma x\Sigma y}{[n\Sigma^2 - (\Sigma x)^2]\,[b\Sigma y^2 - (\Sigma y)2]}$$

$$= \frac{9 \times 190440 - 275 \times 6830}{[9 \times 8977 - (275)^2]\,[9 \times 8,675,000 - (6830)^2]}$$

$$= \frac{-164290}{5168 \times 31{,}426{,}100}$$

$$= \frac{-164290}{162410084800}$$

$= -0.000001$ weak negative correlation

(iii) $R = 1 - \dfrac{6\left(\Sigma d2 + \dfrac{t3 - t}{12}\right)}{n(n2 - 1)}$

$$= 1 - \frac{6\left(177.5 + \dfrac{2^3 - 2}{12}\right)}{9(9^2 - 1)}$$

$= 1 - 1.48333$

$= -0.483333$ weak positive correlation

SOLUTION 3

(a) (i) Critical Path

It one path through the network with EST's and LST's identical. It is the chain of activities which has the longest duration.

(ii) Critical Activity

It is an activity which has EST = LST of tail event, and EST = LST of the head event and the EST of the head event minus the EST of the tail event equal the activity duration.

(iii) Project Duration

It is amount of time it takes to complete all activities in a project.

(iv) Activity Duration

It is amount of time needed to complete an activity of a project.

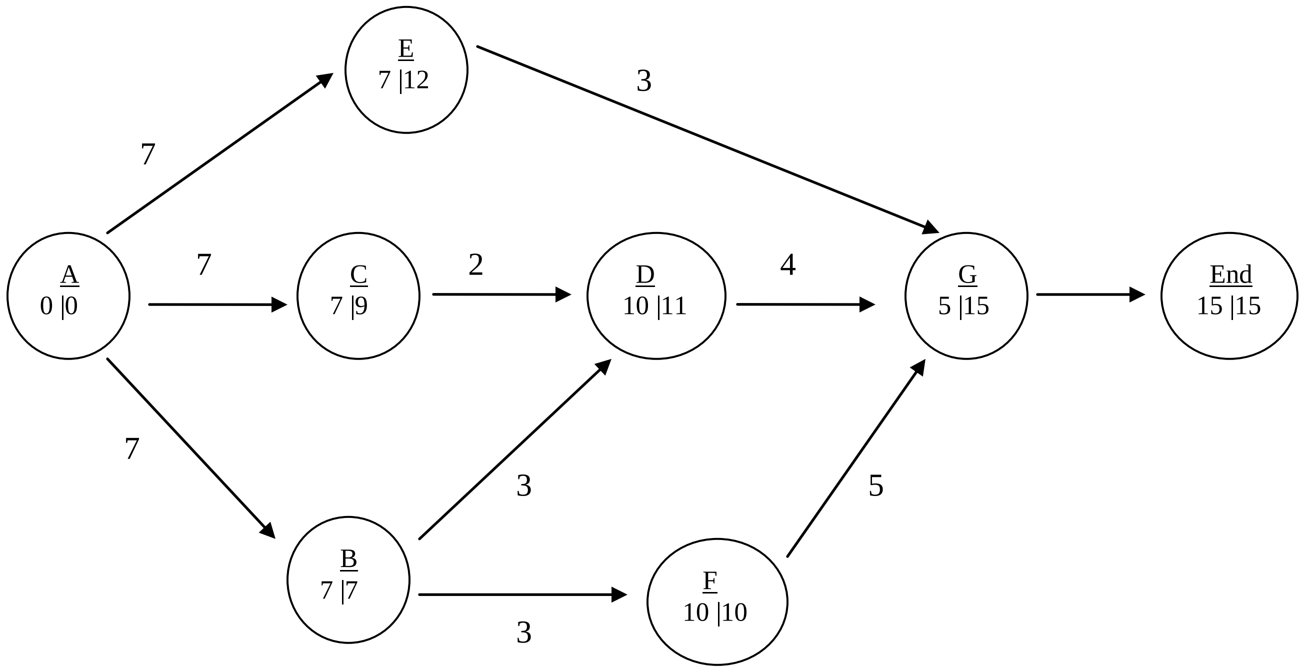
(v) Total Float

This is the amount of time a path of activities could be delayed without affecting the overall project duration.

(b) (i)

A - F - G	10 days
A - C - D - G	13 days
A - B - E G	15 days
A - B - D G	14 days

(ii)



Project duration = 15 days

Critical path is A -B -E -G

(iii)

Activity	Duration	EST	LST	Total Float (LST – Duration – EST)
AB	7	0	7	0
AC	7	0	9	2
AF	7	0	12	5
BD	3	7	11	1
BE	3	7	10	0
EG	5	10	15	0
FG	3	7	15	5
CD	2	7	11	2
DG	4	10	15	1

(iv) If activity DG takes 8 days, rather than 4 days, the project will delay for 3 days i.e from 15 days to 18 days.

SOLUTION 4

(a) FV = GHC800,000

$i = \frac{0.066}{12} = 0.0055$

$n = 12 \times 5 = 60$

(i) $PMT = FV \cdot \frac{i}{(1 + i)^n - 1}$

$= 800{,}000 \times \frac{0.0055}{(1.0055)^{60} - 1}$

= GHC11,290.42 per month

(ii) $FV = PMT \times \frac{(1 + i)^n - 1}{I}$

For the Interest earned during the 5th year with PMT = GHC11,290.42

i = 0.0055 and n = 12 x 4 = 48

$FV = 11{,}290.42 \times \frac{(1.0055)^{48} - 1}{0.0055}$

= GHC618,277.04 The amount after 4 years.

During the 5th year the amount in the account grew from GHC618,277.04 to GHC800,000.

A portion of this growth was due to the 12 monthly payments of GHC11,292.42. The remainder of the growth was interest.

Thus:

800,000 – 318,277.04 = 181,722.96 Growth in the 5th year.

12 x 11,290.42 = 135,485.04 payment during the 5th year.

181,722.96 – 135,485.04 = GHC46,237.92 Interest during the 5th year

(b) PMT = GHC2,000 I = 0.685 n = 1.0

$FV = PMT \frac{(1 + i)^n - 1}{i}$

$= 2{,}000 \times \frac{(1.0685)^{10} - 1}{0.0685}$

= GHC27,437.89

The amount in the account when Mr. Asempa retires will be:

Using the compound interest formula with P = 27,437.89 I = 0.0685 and n = 25

$A = P(1 + 1)^{n}$

$= 27,437.89 \ (1.0685)^{25}$

A = GHC143,785.10

Mr. Asempa retires with GHC143,785.10 in his account.

SOLUTION 5

(a) (i) Decision Tree

(ii)

Node 1: Expected value at random node
= 0.6 x 12,000 + 0.4 x 4,000 = 8,800

Node 2: Expected value of random node
= 0.6 x 18,000 + 0.4 x 6,000 = 13,200

Node 3: Best alternative at decision node
= maximum of 8,800 and 8,000 = 8,800

Node 4: Best alternative at decision node
= maximum of 13,200 and 12,000 = 13,200

Node 5: Expected value at random node
= 0.1 x 4,000 + 0.7 x 8,000 + 0.2 x 13,200 = 9,200

Node 6: Expected value at random node
= 0.4 x 7,000 + 0.6 x 10,000 = 8,800

Node 7: Best alternative at decision node
= maximum of 7,800 and 8,000 = 8,000

Node 8 Best alternative at decision node
= maximum of 9,200, 8,000 and 8,000 = 9,200

(iii)

The best decision are to buy the Basicor machine and if it produces more than 2,000 units, to export all production. The expected profit from this policy I GHC9,200 a week.

(a) We write the demand as a (3 x 2) matrix D and the selling price as a (2 x 3) matrix P

Then

$$D = \begin{pmatrix} 10 & 80 \\ 40 & 30 \\ 20 & 60 \end{pmatrix} \qquad P = \begin{pmatrix} 4 & 6 & 8 \\ 12 & 16 & 20 \end{pmatrix}$$

(i) Income from each company is given by

$$DP = \begin{pmatrix} 10 & 80 \\ 40 & 30 \\ 20 & 60 \end{pmatrix} \begin{pmatrix} 4 & 6 & 8 \\ 12 & 16 & 20 \end{pmatrix}$$

$$= \begin{pmatrix} 10 \times 4 + 180 \times 12 & 10 \times 6 + 80 \times 16 & 10 \times 8 + 80 \times 20 \\ 40 \times 4 + 30 \times 12 & 40 \times 6 + 30 \times 16 & 40 \times 8 + 30 \times 20 \\ 20 \times 4 + 60 \times 12 & 20 \times 6 + 60 \times 16 & 20 \times 8 + 60 \times 20 \end{pmatrix}$$

$$= \begin{pmatrix} 1,000 & 1,340 & 1,680 \\ 520 & 720 & 920 \\ 800 & 1,080 & 1,360 \end{pmatrix}$$

(ii) The amount each company spent is given by

$$\begin{pmatrix} 1,000 & 1,340 & 1,680 \\ 520 & 720 & 920 \\ 080 & 1,080 & 1,360 \end{pmatrix} \times \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 4,020 \\ 2,160 \\ 3,240 \end{pmatrix}$$

Hence Drobo spent GHC4,020, Keto spent 2,160 and Zuu spent GHC3,240.

(iii) The total expenditure or income of Ntamapa is given by

$$\begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \begin{pmatrix} 4,020 \\ 2,160 \\ 3,240 \end{pmatrix}$$

= GHC9,420.00

SOLUTION 6

(i)

$$\begin{array}{c c} & \begin{matrix} D & R \end{matrix} \\ \begin{matrix} D \\ R \end{matrix} & \begin{pmatrix} 0.7 & 0.4 \\ 0.3 & 0.6 \end{pmatrix} \end{array}$$

(ii)

$$A^2 = \begin{pmatrix} 0.7 & 0.4 \\ 0.3 & 0.6 \end{pmatrix} \begin{pmatrix} 0.7 & 0.4 \\ 0.3 & 0.6 \end{pmatrix} = \begin{pmatrix} 0.61 & 0.52 \\ 0.39 & 0.48 \end{pmatrix}$$

$$A^3 = A2A = \begin{pmatrix} 0.61 & 0.52 \\ 0.39 & 0.48 \end{pmatrix} \begin{pmatrix} 0.7 & 0.4 \\ 0.3 & 0.6 \end{pmatrix} = \begin{pmatrix} 0.583 & 0.556 \\ 0.417 & 0.444 \end{pmatrix}$$

(iii) If the current MPs are males then the initial distribution becomes $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$

After three elections we have

$$\begin{pmatrix} 0.7 & 0.4 \\ 0.3 & 0.6 \end{pmatrix}^3 \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0.583 & 0.556 \\ 0.417 & 0.444 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0.853 \\ 0.417 \end{pmatrix}$$

Therefore 858.3% of the MPs will be males.

SOLUTION 7

Number of class interval, k = 1 + 3.3 log N
= 1 + 3.3 log 30
= 5.87 = 6

$$\text{Class width, } C = \frac{\text{Range}}{k} = \frac{14.3 - 5.2}{6} = 1.52 = 1.5$$

Class Boundaries	Tally	Freq.	Midpoint (2)	fx	fx^2
5.15 - 6.65	|	1	5.9	5.9	34.81
6.65 - 8.15	~~||||~~	5	7.4	37.0	273.80
8.15 - 9.65	~~||||~~ ~~||||~~	9	8.9	80.1	912.89
9.65 - 11.15	~~||||~~ ~~||||~~	10	10.4	104.0	1,081.60
11.15 - 13.15	||||	4	11.9	47.6	566.44
13.65 - 15.45	|	1	13.4	13.4	179.56
		30		288.0	2,849.80

(i) Mean: $\frac{\Sigma fx}{\Sigma f} = \frac{288}{30} = 9.6$

$$\text{std dev} = \sqrt{\frac{1}{n-1}\left(\Sigma fx2 - \frac{1}{n}(\Sigma fx)^2\right)}$$

$$= \sqrt{\frac{1}{29}\left(2849.10 - \frac{1}{30}(288)^2\right)}$$

$$= 1.71496$$

$$\text{Coefficient of variation} = \frac{\text{Standard Deviation}}{\text{mean}}$$

$$= \frac{1.70496}{96} = \underline{\underline{0.1776}}$$

(ii) Median position $= \left(\frac{30}{2}\right)^{th} = 15^{th}$

Median class -= 8.15 = 9 – 65

$$M = 1m\left(\frac{n/2 - fem}{fm}\right)cm = 8.15 + \left(\frac{15 - 6}{9}\right)1.5$$

$$= 9.65$$

(iii) $$\text{Skewness} = \frac{3\,(\text{mean} - \text{median})}{\text{standard deviation}} = \frac{3\,(9.6 - 9.65)}{1.7096} = \underline{\underline{-0.0877}}$$

$$\text{Kurtosis} = \frac{\frac{1}{2}(Q3 - Q1)}{P_{90} - P_{10}}$$

$$Q3 = 9.65 + \left(\frac{30(\frac{3}{4}) - 15}{10}\right)1.5 = \underline{\underline{10.775}}$$

$$Q1 = 6.65 + \left(\frac{10(\frac{1}{4}) - 1}{5}\right)1.5 = 8.6$$

$$P_{90} = 11.15 + \left(\frac{30(0.9) - 25}{4}\right)1.5 = 11.9$$

$$P_{10} = 6.65 + \left(\frac{30(0.1) - 1}{5}\right)1.5 = 7.25$$

$$\text{Kurtosis} = \frac{\frac{1}{2}(10.775 - 8.6)}{11.9 - 7.25} = 0.234$$