CMA JANUARY, 2022 EXAMINITION
FOUNDATION LEVEL
SUBJECT: TA112 - BUSINESS QUANTITATIVE ANALYSIS

Model Solution

Solution of the question No. 1

i. (c)
ii. (c)
iii. (c)
iv. (a)
v. (c)
vi. (c)
vii. (b)
viii. (c)
ix. (b)
x. (d)

Solution of the question No. 2

(a) False. Graph of a linear polynomial is a straight line.
(b) True
(c) False. The set {1, 2, 4, 5} is the symmetric difference of A= {1, 2, 3} and B={3, 4, 5}
(d) False. A collection of 11 best hockey player of Bangladesh is not a set.
(e) False. The growth process which is characterized by constant decrease in percentage of values is referred as exponential decay process.
(f) False. The function which describes increase of 7% in country population is classified as exponential function of growth.
(g) False. The letters of the word 'LEADER' can be arranged in 720 ways.
(h) True
(i) True
(j) False. A sinking fund is an investment of a constant annual amount.

Solution of the question No. 3

(a)

Let U = the set of people surveyed
N = set of those peoples that read newspapers
R = set of those peoples that listened to radios
T = set of those peoples that watched televisions
We have n (U) = 525, n(N) = 350, n(R) = 215, n(T) = 140, n(N∩T) = 75, n(R∩T) = 40, n(N∩R) = 100, n(N∩R∩T) = 25
To find:

$$n(N' \cap R' \cap T') = n(N \cup R \cup T)' = n(U) - n(N \cup R \cup T)$$
$$= n(U) - [n(N) + n(R) + n(T) - n(N \cap R) - n(R \cap T) - n(N \cap T) + n(N \cap R \cap T)]$$
$$= 525 - [350 + 215 + 140 - 100 - 40 - 75 + 25] = 10$$

(b)

We first combine the terms on the right side into a single logarithm

$$\log y = \log 5.934 + 0.885 \log x$$
$$\log y = \log 5.934 + \log x^{0.885}$$
$$\log y = \log (5.934 x^{0.885})$$
$$y = 5.934 x^{0.885}$$

When y = 0 then x = 0

Solution of the question No. 4

(a) Hence the Formula is $P = \frac{A}{r}[1 - \frac{1}{(1+r)^n}]$

When, P=1,50,000, r=10%=0.10, n=15, A=?
Now putting the values in the above equation.

We get $1,50,000 = \frac{A}{0.10}[1 - \frac{1}{(1+0.10)^{15}}]$

Or, $1,50,000 = \frac{A}{0.10}(0.761)$

Or, $A = \frac{1,50,000 \times 0.10}{0.761}$

Or, A= Tk. 19,910
Therefore he will have to pay Tk. 19,710 annually.

(b) The candidate can select the questions:

Part-A(5)	Part-B(5)	Have to answer (6)
2	4	6
3	3	6

4	2	6

Therefore

$$5_{C_2} \times 5_{C_4} + 5_{C_3} \times 5_{C_3} + 5_{C_4} \times 5_{C_2} = 200.$$

Solution of the question No. 5

(a) Statement showing ranking of projects (in descending power of profitability index) and their NPV.

Project	Investment	Profitability Index	Gross Present Value	Net Present Value
1	2	3	4 (col 2×col 3)	5 (col 4-col 2)
1	3,00,000	1.22	Tk. 3,66,000	Tk. 66,000
3	3,50,000	1.20	Tk. 4,20,000	Tk. 70,000
5	2,00,000	1.20	Tk. 2,40,000	Tk. 40,000
4	4,50,000	1.18	Tk. 5,31,000	Tk. 81,000
6	4,00,000	1.05	Tk. 4,20,000	Tk. 20,000

Notes: (i) Project 2 has been excluded in view of its profitability index being less than one, implying negative NPV (ii) Since Project 3 has a higher profitability index, it has been assigned a higher rank than project 5.

S Ltd. is advise to undertake projects 4,3 and 5 as this package holds potentials of yielding the maximum NPV of Tk. 1,91,000 (Tk. 81,000+Tk. 70,000+Tk. 40,000)

(b) The payback period is = $\frac{Tk.36,000}{Tk.11,200}$ = 3.214 years. Discount factors closest to 3.214 for 5 years are 3.274 (16 percent rate of interest) and 3.199 (17 percent rate of interest) The actual value of IRR which lies between 16 percent and 17 percent.

IRR = r [$\frac{PVco - PVcfat}{\Delta PV}$]$\times\Delta\pi$

Where PVco = Present value of cash outlay

PVcfat = Present value of cash inflows

Δr=Difference in interest rates and

ΔPV=Difference in calculated present value of inflows.

IRR=17- [$\frac{3.214 - 3.199}{3.274 - 3.199}$]=16.8 percent

SECTION-B [50 MARKS]

Solution of the question No. 6

i. (b)

ii. (e)

iii. (a)

iv. (c)

v. (b)

vi. (a)

vii. (a)

viii. (b)

ix. (d)

x. (e)

Solution of the question No. 7

(a) False. The arithmetic mean is a measure of central tendency.

(b) True

(c) True

(d) False. If the correlation coefficient is 0.8, then the coefficient of determination is 0.64.

(e) True

(f) True

(g) False. Type 1 error occurs when we reject H_0 if it is True.

(h) True

(i) False. Fisher's index number is based on GM of Laspeyres and Paasche's index.

(j) True

Solution of the question No. 8

(a)

CALCULATION OF COEFFICIENT OF CORRELATION

Price (Tk) X	(X-90) dx	d^2_x	Sales Y	(y-7) dy	d^2_y	$d_x d_y$
100	+10	100	5	-2	4	-20
90	0	0	6	-1	1	0
85	-5	25	7	0	0	0
92	+2	4	6	-1	1	-2
90	0	0	8	0	0	0
84	-6	36	8	+1	1	-6
88	-2	4	8	+1	1	-2
90	0	0	7	0	0	0
∑=719	∑dx=-1	$\sum d^2x$=169	∑y=54	∑dy=-2	$\sum d^2y$=8	∑dxdy=-3

$$r= \frac{N\sum dxdy-(\sum dx)(\sum dy)}{\sqrt{N\sum d^2x-(\sum dx)^2}\sqrt{N\sum d^2y-(\sum dy)^2}}$$

N=8, ∑dxdy=-30, ∑dx=-1, ∑dy=-2, $\sum d^2x$=169, $\sum d^2y$=8

$$r= \frac{8(-30)-(-1)(-2)}{\sqrt{8(169)-(-1))}\sqrt{8(8)-(-2)^2}}$$

$$= \frac{-240-2}{\sqrt{1352-1}\sqrt{64-4}}$$

$$= \frac{-242}{\sqrt{1351\times 60}} = \frac{-242}{284.71}$$

=-0.85

There is a high degree of negative correlation between price and sales.

(b) Prepare the following table:

x	d_x = x-**62**	y	d_y = y-**62**	d_x^2	d_y^2	d_x*d_y
50	-12	52	-10	144	100	120
52	-10	50	-12	100	144	120
55	-7	57	-5	49	25	35
60	-2	65	3	4	9	-6

62	0	65	3	0	9	0
65	3	62	0	9	0	0
65	3	65	3	9	9	9
60	-2	65	3	4	9	-6
70	8	71	9	64	81	72
75	13	70	8	169	64	104
620	$\sum dx$ = -6	622	$\sum dy$ = 2	$\sum dx^2$= 522	$\sum dy^2$= 450	$\sum dxdy$ = 448

$$b_{xy} = \frac{\sum dxdy - \frac{\sum dx \sum dy}{N}}{\sum dx^2 - \frac{(\sum dx)^2}{N}} = \frac{448 - \frac{-12}{10}}{522 - \frac{(-6)^2}{10}} = \frac{448 + 1.2}{522 - 3.6} = \frac{449.2}{518.4} = 0.87$$

$$y - \bar{y} = b_{yx}(x - \bar{x}) \Rightarrow y - 62.2 = 0.87(x - 62) \Rightarrow y - 0.87x = 62.2 - 53.94$$

$$\Rightarrow y - 0.87x = 8.26$$

Solution of the question No. 9

(a)

	Rajshahi	Chattogram	Dhaka	Jashore	Total
Yes	45	55	60	50	210
No	35	45	35	45	160
No opinion	5	5	5	5	20
Total	85	105	100	100	390

Let the event A denote that a consumer selected at random professed brand A.

(i) P(A)= $\frac{210}{390} = \frac{7}{13}$ =0.5385

(ii) (A∩C)= $\frac{60}{390} = \frac{2}{13}$ =0.1538

(iii) P(A/C)= $\frac{P(A \cap M)}{P(M)} = \frac{60/390}{100/390} = \frac{3}{5}$ =0.6

(iv) P(M/A)= $\frac{P(B \cap A)}{P(A)} = \frac{50/390}{210/390} = \frac{5}{21}$ =0.238

Solution of the question No. 10

(a)

Construction of Price Index

	Base year		Current year		p_1q_0	p_0q_0	p_1q_1	p_0q_1
	Kilo	Rate (Tk.)	Kilo	Rate (Tk.)				
Bread	10	3	8	3.25	32.50	30	26	24
Meat	20	15	15	20.00	400.00	300	300	225
Tea	2	25	3	23.00	46.00	50	69	75
				Total	478.50	380	395	324

(i) Laspeyre's method

$$P_{01} = \frac{\sum p_1 q_0 \times 100}{\sum p_0 q_0} = \frac{478.50 \times 100}{380.00} = 125.9$$

(ii) Paasche's method

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{395 \times 100}{324} = 121.9$$

(iii) Bowley's method

$$P_{01} = \frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100 = \frac{\frac{478.5}{380.0} + \frac{395}{324}}{2} \times 100 = 123.9$$

or $\frac{L+P}{2} = \frac{125.9+121.9}{2} = 123.9$

(iv) Fisher's ideal formula

$$P_{01} = \sqrt{L} \times P = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$

$$= \sqrt{\frac{478.5}{380} \times \frac{395}{324}} \times 100$$

$$= \sqrt{1.259 \times 1.219} \times 100$$

$$= 1.239 \times 100 = 123.9$$

(v) Marshall Edge worth method

$$P_{01} = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100 = \frac{478.5 + 395}{380.0 + 324} \times 100$$

$$= \frac{873.5 \times 100}{704} = 1.24 \times 100 = 124.$$

(b) Let us, take the null hypothesis that there is no significant difference in the proportion of defective items in the two offices.

$P_1 = \frac{x_1}{n_1} = \frac{35}{250} = 0.14$, $P_2 = \frac{x_2}{n_2} = \frac{27}{300} = 0.09$

$$Z=\frac{P_1-P_2}{\sqrt{P(1-P)(\frac{1}{n_1}+\frac{1}{n_2})}}$$

$$P=\frac{n_1p_1+n_2p_2}{n_1+p_2}=\frac{x_1+x_2}{n_1+n_2}\ \frac{35+27}{250+300}=0.1127$$

$$Z=\frac{0.14-0.09}{\sqrt{(0.1127)(0.8873)(0.0073)}}=\frac{0.05}{0.027}=1.85$$

Since, the computed value of z is less than the critical value of Z=2.58 at 1% level of significance, therefore, our null hypo thesis holds good. Hence, there is no significant difference in the errors in return in two different offices.