

[4]

- iii Explain the following terms-
- Null hypothesis
 - Alternative hypothesis
 - Sample
 - Population
 - Degree of freedom

5 0 07 01
1

Total No. of Questions: 6

Total No. of Printed Pages: 4

Q.6 Attempt any two:

- i. A person wants to invest in one of three alternative investment plans; stocks, bonds or a saving account. It is assumed that the person wishes to invest all of the funds in one plan. The conditional payoffs of the investments are based on three potential economic conditions: accelerated, normal or slow growth. The payoff matrix is given below:

Alternative Investments	Economic conditions		
	Accelerated Growth	Normal Growth	Slow Growth
Stocks	Rs.10,000	Rs.6,500	Rs. 4000
Bonds	Rs.8,000	Rs.6,000	Rs.1000
Savings	Rs.5,000	Rs.5,000	Rs.5,000

Determine the best invest plan using Hurwicz with coefficient of optimism $\alpha = 0.6$

- ii. A newspaper distributor assigns probabilities to the demand for a magazine as follows

Copies Demanded	1	2	3	4
Probability	0.4	0.3	0.2	0.1

A copy of magazine sells for Rs.7, costs Rs.6. What can be the maximum possible EMV if distributor can return the unsold copies for Rs. 5 each?

- iii. Explain any five steps involved in decision making process.

5 0 01 02
3 2



Knowledge is Power

Enrollment No.....

Faculty of Management Studies

End Sem Examination Dec 2024

MS3CO22 Quantitative Techniques

Programme: BBA

Branch/Specialisation:

Management

Maximum Marks: 60

Duration: 3 Hrs.

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- | Marks | BL | PO | CO | PSO | | | |
|-------|--|-----|----|-----|---|-----|---------------|
| Q.1 | 1 | 0 | 07 | 01 | | | |
| i. | Increase in the number of patients in hospital due to heat stroke is- | | | | | | |
| (a) | Secular Trend | | | | | | |
| (b) | Irregular Variation | | | | | | |
| (c) | Seasonal Variation | | | | | | |
| (d) | None of these | | | | | | |
| ii. | Time series is consisting of- | | | | | | |
| (a) | Short term variation | | | | | | |
| (b) | Long term variation | | | | | | |
| (c) | Irregular variation | | | | | | |
| (d) | All of these | | | | | | |
| iii. | Index number is a type of- | | | | | | |
| (a) | Dispersion | | | | | | |
| (b) | Correlation | | | | | | |
| (c) | Average | | | | | | |
| (d) | None of these | | | | | | |
| iv. | The weights used in a quantity index are- | | | | | | |
| (a) | Quantity | | | | | | |
| (b) | Values | | | | | | |
| (c) | Price | | | | | | |
| (d) | None of these | | | | | | |
| v. | $\rho(x) = \frac{(e^{-2}(2)^3)}{3!}$ The mean value is- | | | | | | |
| (a) | 1 | (b) | 2 | (c) | 3 | (d) | None of these |
| vi. | For a standard normal probability distribution, the mean (μ) and the standard deviation (s) are- | | | | | | |
| (a) | $\mu = 0, s = 1$ | | | | | | |
| (b) | $\mu = 16, s = 4$ | | | | | | |
| (c) | $\mu = 25, s = 5$ | | | | | | |
| (d) | None of these | | | | | | |
| vii. | Goodness of fit of a distribution is tested by- | | | | | | |
| (a) | T-test | | | | | | |
| (b) | Chi-square Test | | | | | | |
| (c) | F-Test | | | | | | |
| (d) | None of these | | | | | | |

P.T.O.

[2]

- viii. The probability of rejecting the null hypothesis when it is true is called the

0 01 01
2 2

- (a) Level of confidence (b) Level of significance
(c) Power of test (d) None of these

ix. The decision-making criterion that should be used to achieve maximum long term payoff is- 1 0 07 01
1

- (a) EOL
 - (b) EMV
 - (c) Hurwicz
 - (d) None of these

x. Decision theory is concerned with-

- (a) Methods of arriving at an optimal decision
 - (b) Selecting optimal decision in a sequential manner
 - (c) Analysis of information that is available
 - (d) All of these

Q.2 Attempt any two:

- i. Calculate 5-yearly moving average of production for the given data:

Years	Production
2006	21
2007	30
2008	36
2009	42
2010	46
2011	50
2012	56
2013	63
2014	70
2015	74

ii. Given below are the figures of production of a sugar factory- 5 0 01 03

Year	Production
2008	40
2009	45
2010	46
2011	42
2012	47
2013	49
2014	46

Fit a straight-line trend by method of least squares and estimate its values for 2017.

[3]

- iii Explain the following components of time series in brief- **5**

Q.3

- Attempt any two:

 - Explain any five problems keeping in mind before constructing index number. **5** 0 01 01
2 2
 - Calculate Fisher's Ideal Index from the following data and prove that it satisfies the time reversal tests. **5** 0 07 02
3

	2002		2003	
Commodity	Price	Expenditure	Price	Expenditure
A	8	80	10	120
B	10	120	12	96
C	5	40	5	50
D	4	56	3	60
E	20	100	25	150

- iii. Write the steps for the construction of cost living index. **5** 0 07 01
2

Q.4

Q.5

- Attempt any two:

i. Find the student's t-statistic for the following variable **5** 0 01 02
values in a sample:

-4, -2, -2, 0, 2, 2, 3, 3

taking the mean of the universe to be zero.

- ii. From the table given below, whether the colour of son's eyes is associated with that of father's eyes? Given that the values of χ^2 for 1 degree of freedom at 5% level of significance is 3.841.

Eye Colour is Son's

	Not Light	Light	
Eye colour in Father	Not Light	230	148
	Light	151	471

MEDI-CAPS UNIVERSITY

END SEM EXAMINATION

(1)

Solution of MS3C022 - Quantitative Techniques
ques

Programme : BBA

BRANCH - Management

Q1.

- | | |
|----------------------------------|----|
| (i) (c) Seasonal variation | +1 |
| (ii) (d) All of these | +1 |
| (iii) (c) Average | +1 |
| (iv) (c) Price | +1 |
| (v) (b) 2 | +1 |
| (vi) (a) $\mu=0, S=1$ | +1 |
| (vii) (b) Chi-Square test | +1 |
| (viii) (b) Level of Significance | +1 |
| (ix) (b) EMV | +1 |
| (x) (d) All of these | +1 |

(2)

Q2

(i)

Years	Production	Average
2006	21	
2007	30	+ 2
2008	36	$175/5 = 35$
2009	42	$204/5 = 40.8$
2010	46	$230/5 = 46$
2011	50	$257/5 = 51.4$
2012	56	$285/5 = 57$
2013	63	$313/5 = 62.6$
2014	70	+ 1
2015	74	

The trends for years are

2008 - 35	+ 2
2009 - 40.8	
2010 - 46	
2011 - 51.4	
2012 - 57	
2013 - 62.6	

Q2
(ii)

(X) Year	(Y) Production	$X = x - \bar{x}$	x^2	xy
2008	40	$2008 - 2011 = -3$	9	-120
2009	45	$2009 - 2011 = -2$	4	-90
2010	46	$2010 - 2011 = -1$	1	-46
2011	42	$2011 - 2011 = 0$	0	0
2012	47	$2012 - 2011 = 1$	1	47
2013	49	$2013 - 2011 = 2$	4	98
2014	46	$2014 - 2011 = 3$	9	138
$\sum Y = 315$			28	27

equation of line is $Y = a + bx$

gts normal equation is

$$\sum Y = na + b \sum X$$

$$\sum XY = a \sum X + b \sum X^2$$

+ 1

Shifting X to origin

$$a = \frac{\sum Y}{n} \quad b = \frac{\sum XY}{\sum X^2}$$

$$a = \frac{315}{7} = 45 \quad b = \frac{27}{28} = 0.96$$

line is $Y = 45 + 0.96X$

+ 1

$$\text{Pred for } 2017 \quad X = 2017 - 2011 = 6$$

$$Y_{2017} = 45 + 0.96 \times 6 = 45 + 5.76 = 50.76$$

(iii)

(a) Secular Trend :-

General tendency of the time Series data to increase or decrease or stagnate during a long period of time is called the Secular trend or simply a trend.

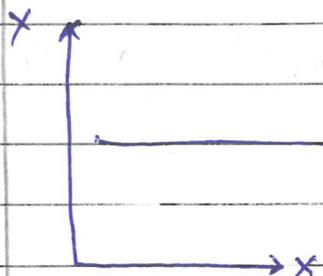
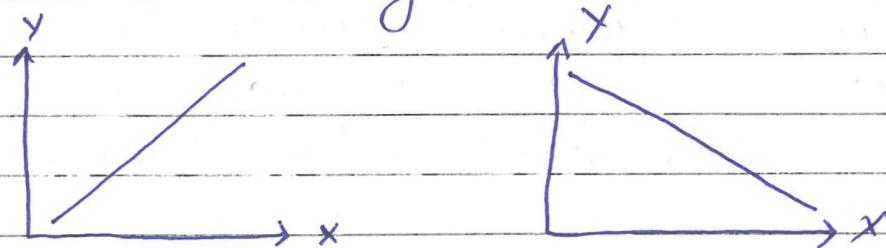
Broadly the trends are divided into two heads

+ 2

(a) Linear Trends

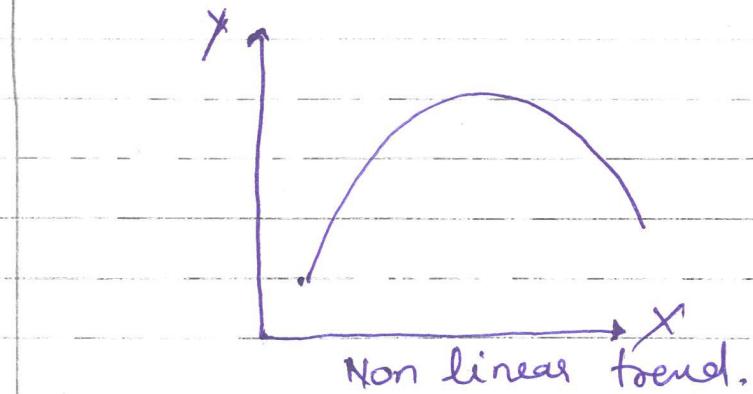
(b) Non linear Trends

Linear Trends : If graph is plotted it will show straight line.



+ 0.5

Non linear Trends : In business or economics generally growth is slow in beginning and then it is rapid for some time period after which it becomes stable for some time period and finally retards gradually

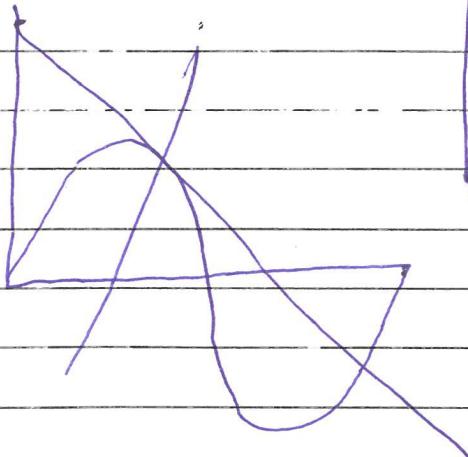
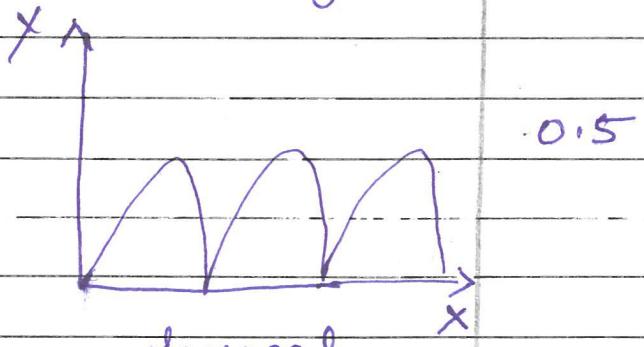


for example: Admission of B.tech students in a university

(b) Seasonal Variation: Seasonal Variation represent a periodic movement where the period is not longer than one year. The factors which mainly cause this type of variation in time series are the climatic changes. For example

+ 2

- (a) Sale of woollens go up in winter
- (b) Sale of raincoats & umbrella go up in rainy season.



Q3

(i)

five problems arises in the construction of index number are:

(a) The purpose of the index :-

The problem of the scope of the index i.e field covered by the index is bound up with the purpose of the index and data available. The data available or rather the lack of them may necessitate the modification of purpose

(b) Selection of base period :- The base period should be normal one. The period that is selected for base period should be free from abnormalities like wars, earthquakes etc.

(c) Selection of number of items :- The items included in an index should be determined by the purpose for which index is constructed. Commodities that are chosen for calculation of index are chosen wisely.

(d) Price Quotations ; After commodities have been selected. The next problem is to obtain Price Quotations for these commodities. In order to ensure uniformity the manner in which prices are to be quoted must be decided.

(7)

(e)

Selection of appropriate weights - The problem of selecting suitable weights is quite important and at the same time it is difficult also.

+1

Q2(ii)

Commodity	2002		2003	
	P ₀	q ₀	P ₁	q ₁
A	8	10	10	12
B	10	12	12	8
C	5	8	5	10
D	4	14	3	20
E	20	5	25	6

+2.5

P ₁ q ₀	P ₀ q ₀	P ₁ q ₁	P ₀ q ₁
100	80	120	96
144	120	96	80
40	40	50	50
42	56	60	80
125	100	150	120
451	396	476	426

$$P_{01} = \sqrt{\frac{451}{396} \times \frac{476}{426}} \times 100 = 112.8$$

$$P_{10} = \sqrt{\frac{426}{476} \times \frac{396}{451}} \times 100 = \sqrt{0.89 \times 0.87} \\ = 0.8799 \times 100 \\ = 87.99.$$

To check for time reversal

$$P_{01} \times P_{10} = \frac{451 \times 476 \times 426}{396 \times 426 \times 476} \times \frac{396}{451}$$

+2.5

$$= \sqrt{1} = 1$$

Hence Time reversal test ~~is~~
Satisfied.

(iii) The steps for the Construction of Cost of living Index are

(i) First step is the decision about the class of people whom for index number is meant. It is also necessary to decide geographical area

+1

(ii) Second Step is to Conduct a family budget enquiry @ Food b) clothing
 (c) Fuel & light (d) Housing (e) Miscellaneous

+1

(iii) Third Step is to collect retail price of items from the market

+1

(iv) After the collection of Retail prices we will find average price of each item. Such average is first calculated for each base period & then for every month or year

(v) As the relative importance of various items for different classes of people is not same price relatives are always weighted.

+1

(9)

Q4

(i) Number of trials (n) = 12Probability of getting a head (p) = $\frac{1}{2}$ Probability of not getting a head (q) = $1 - \frac{1}{2}$

$$= \frac{1}{2}$$

+ 1

Using Binomial distribution $P(x) = nCx p^x q^{n-x}$

Probability of getting 8 heads

$$P = 12C_8 \left(\frac{1}{2}\right)^8 \left(\frac{1}{2}\right)^{12-8}$$

+ 2

$$= \frac{12!}{8! 4!} \left(\frac{1}{2}\right)^8 \left(\frac{1}{2}\right)^4$$

$$P = \frac{12 \times 11 \times 10 \times 9 \times 8!}{4 \times 3 \times 2 \times 1 \times 8!} \times \frac{1}{256} \times \frac{1}{16}$$

$$P = \frac{495}{256 \times 16}$$

$$\text{Expected heads} = \frac{256 \times 495}{256 \times 16} = \frac{495}{16} = 30.93$$

+ 1

 ≈ 31 heads.

Q4

(ii) The properties of normal Curve are

- (a) It is bell shaped +1
- (b) The area under the Curve is 1 +1
- (c) Normal Curve is Symmetric about its axes +1
- (d) Mean = Median = Mode coincide in normal distribution +1

(e) The highest peak of normal Curve is its mean. +1

(iii) Number of trials $n = 5$ probability of getting head $p = \frac{1}{2}$ +1probability of getting tail $q = 1 - \frac{1}{2} = \frac{1}{2}$

(a) Probability of getting exactly two heads

$$= nCr p^r q^{n-r} = 5C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^{5-2}$$

+2

$$= 5C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^3$$

$$= \frac{5!}{2! 3!} \times \frac{1}{4} \times \frac{1}{8}$$

$$= \frac{5 \times 4 \times 3!}{2! \times 3!} \times \frac{1}{4} \times \frac{1}{8}$$

$$= \frac{5}{8 \times 2} = \frac{5}{16} = 0.3125$$

~~10~~

(11)

(b) Probability of getting at most one head

$$P(r=0) + P(r=1)$$

+2

$$= {}^5C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{5-0} + {}^5C_1 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^{5-1}$$

$$= 1 \times 1 \times \frac{1}{32} + \frac{5!}{4! \cdot 1!} \times \frac{1}{32}$$

$$= \frac{1}{32} + \frac{5 \times 4 \times 3 \times 2}{4!} \times \frac{1}{32}$$

$$= \frac{1}{32} + \frac{5}{32} = \frac{6}{32} = 0.1875$$

Q5
(i)

S.no	x	$x - \bar{x}$	$(x - \bar{x})^2$
1	-4	-4.25	18.0625
2	-2	-2.25	5.0625
3	-2	-2.25	5.0625
4	0	-0.25	0.0625
5	2	1.75	3.0625
6	2	1.75	3.0625
7	3	2.75	7.5625
8	3	2.75	7.5625
	$\sum x = 2$		49.5000

$$\text{Mean} = \frac{\sum x}{n} = \frac{2}{8} = 0.25$$

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{49.5}{7}} + 1$$

$$= \sqrt{7.071428} = 2.659$$

The mean of universe $M=0$ we get

$$\text{Student's } t = \frac{(\bar{x} - M) \sqrt{n}}{S} = \frac{(0.25 - 0) \sqrt{8}}{2.659} + 1$$

$$= 0.27$$

Q5
(ii)

Step 1: H_0 : The color of the Son's eyes is not associated with the colour of father's eyes +1

H_1 : The color of the son's eyes is associated with the color of father's eyes

Step 2:

Observed freq.	expected freq.
----------------	----------------

O_i

e_i

230

$$\frac{378 \times 381}{1000} = 144$$

148

$$\frac{378 \times 619}{1000} = 234$$

151

$$\frac{381 \times 622}{1000} = 237$$

471

$$\frac{619 \times 622}{1000} = 385$$

Step 3:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

$$= \frac{(230 - 144)^2}{144} + \frac{(148 - 234)^2}{234} + \frac{(151 - 237)^2}{237} + 1 \\ + \frac{(471 - 385)^2}{385} = -51.36 + 31.61 + 31.21 \\ + 19.21 = 133.29$$

degree of freedom $\text{Df} = (R-1)(C-1) = (2-1)(2-1) = 1$

Step 4: The value of χ^2 at 5% level of significance & 1 degree of freedom is 3.84

Step 5: Clearly Calculated value of χ^2 is much greater than tabulated value

+ 1

Step 6: The null hypothesis is rejected.

Q5(iii)

- (a) Null hypothesis :- Denoted as H_0 is a statement about a population parameter such as the population mean, that is assumed to be true. The null hypothesis is starting point. We will test whether the value stated in the null hypothesis is likely to be true.
- (b) Alternative hypothesis:- An alternative hypothesis is a statement that directly contradicts a null hypothesis by stating that actual value of population parameter is less than, greater than or not equal to value stated in the null hypothesis.
- (c) Sample :- In statistic, a sample is a subset of a larger group or population that is used to represent the characteristics of the whole population.
- (d) Population :- A population is the entire group of individuals or objects that study is concerned with.

(e) degree of freedom :- The number of independent variables that can be estimated in statistical analysis and tell how many items can be randomly selected. before Constraints must be put in place.

+1

Q6.

	S1	S2	S3
(i) Alternative investment	Accelerated growth	Normal Growth	Slow growth
A1 Stocks	10,000	6,500	4000
A2 Bonds	8000	6000	1000
A3 Savings	5000	5000	5000

+2

For Huawei cz Criteria = $\alpha(\max \text{ profit}) + (1-\alpha) \text{ minimum}$

	Max	Min	
For A1	10,000	4000	$10000 \times 0.6 + 4000 \times 0.4 = 6000 + 1600 = 7600$ +2
A2	8000	1000	$8000 \times 0.6 + 1000 \times 0.4 = 4800 + 400 = 5200$
A3	5000	5000	5000

So max profit is stock i.e 7600 +1

Q6

(ii)

~~Creating payoff~~

	$s_1(1)$	$s_2(2)$	$s_3(3)$	$s_4(4)$
$A_1(1)$	$1 \times 7 - 6 \times 1$			
$A_2(2)$	$1 \times$			
$A_3(3)$				
$A_4(4)$				

Q6

(ii)

~~Creating payoff~~

	$s_1(1)$	$s_2(2)$	$s_3(3)$	$s_4(4)$
A_1	$1 \times 7 - 1 \times 6 = 1$	$1 \times 7 - 1 \times 6 = 1$	$1 \times 7 - 1 \times 6 = 1$	$1 \times 7 - 1 \times 6 = 1$
A_2	$1 \times 7 + 1 \times 5 - 2 \times 6 = 0$	$2 \times 7 - 2 \times 6 = 2$	$2 \times 7 - 2 \times 6 = 2$	$2 \times 7 - 2 \times 6 = 2$
A_3	$1 \times 7 + 2 \times 5 - 3 \times 6 = -1$	$2 \times 7 + 1 \times 5 - 3 \times 6 = 1$	$3 \times 7 - 3 \times 6 = 3$	$3 \times 6 - 3 \times 6 = 0$
A_4	$1 \times 7 + 3 \times 5 - 4 \times 6 = -2$	$2 \times 7 + 2 \times 5 - 4 \times 6 = 0$	$3 \times 7 + 1 \times 5 - 4 \times 6 = -2$	$4 \times 7 - 4 \times 6 = 4$

Now EMV

	s_1	s_2	s_3	s_4
A_1	$0.4 \times 1 = 0.4$	$0.3 \times 1 = 0.3$	$0.2 \times 1 = 0.2$	$0.1 \times 1 = 0.1$
A_2	$0.4 \times 0 = 0$	$0.3 \times 2 = 0.6$	$0.2 \times 2 = 0.4$	$0.1 \times 2 = 0.2$
A_3	$0.4 \times -1 = -0.4$	$0.3 \times 1 = 0.3$	$0.2 \times 3 = 0.6$	$0.1 \times 3 = 0.3$
A_4	$0.4 \times -2 = -0.8$	$0.3 \times 0 = 0$	$0.2 \times 2 = 0.4$	$0.1 \times 4 = 0.4$

On summing

$$A_1 = 0.4 + 0.3 + 0.2 + 0.1 = 1$$

Max is

$$A_2 = 0 + 0.6 + 0.4 + 0.2 = 1.2$$

$$A_2 = 1.2 + 1$$

$$A_3 = -0.4 + 0.3 + 0.6 + 0.3 = 0.8$$

$$A_4 = -0.8 + 0 + 0.4 + 0.4 = 0$$

Q6
(iii)

The five steps in decision making are

(i) Define the problem

+1

(ii) Gather the data

+1

(iii) Identify alternatives

+1

(iv) Establish Solution Criteria

+1

(v) Evaluate alternatives

+1

(vi) Select the best alternatives

+1