

**COVENANT UNIVERSITY
NIGERIA**

*TUTORIAL KIT
OMEGA SEMESTER*

**PROGRAMME: POLITICAL
SCIENCE**

COURSE: PSI 121

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PSI 121: BASIC STATISTICS IN SOCIAL AND POLITICAL SCIENCE

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QUESTIONS

1. Explain the Classification of Time-Series Movements
2. With suitable graphical representations, explain the various components of time series.
3. Explain the following ways of estimating trends.
4. With the aid of suitable graphs, explain the following
 - i. Positive linear correlation
 - ii. Negative Linear Correlation
 - iii. No Correlation

5. Calculate the coefficient of correlation from the following data between x and y.

x	1	3	4	7	10	12	13	14
y	9	7	3	2	5	7	10	10

6. Find Karl Pearson's coefficient of correlation from the following data between height of father (x) and son (y).

X	64	65	66	67	68	69	70
Y	66	67	65	68	70	68	72

7. Define correlation and explain its uses
8. With suitable graphical representations, explain the various components of time series.

9. Compute Spearman's rank correlation coefficient for these two variables of the scores of six selected officers in a job placement test in a bank

Name	Placement score x	Performance Score y
Jessica	92	84
Bolu-Martins	88	77
Melina	86	77
Priscilla	82	78

Ife	70	64
Emeka	96	88

10. With the aid of scatter plots derived from the table below showing relationships between Price (p) and quantity demanded (Qd) for products A,B and C, explain the various types of correlation

P	10	20	30	40	50	60	70	80	90	100
Qd for A	1000	800	700	400	500	300	450	200	350	150
Qd for B	100	150	130	400	250	550	500	700	650	1000
Qd for C	100	1000	500	200	100	600	300	700	400	500

11. The table below shows the respective heights X and Y of a sample of 12 fathers and their sons.

X of father	65	63	67	64	68	62	70	66	68	67	69	71
Y of son	68	66	68	65	69	66	68	65	71	67	68	70

12. Given the table below;

x	5	2	12	9	15	6	25	16
y	64	87	50	71	44	56	42	60

Determine the regression of y on x

13. A six-sided fair dice is rolled once. Find the probability that the side that shows up is

- (a) either a 1 or a 5
- (b) either an even number or an odd number
- (c) either an even number or a prime number

14. Explain the uses of Time Series Analysis.

15. Calculate coefficient of correlation from the following data.

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

16. Calculate Pearson's Coefficient of correlation.

X	45	55	56	58	60	65	68	70	75	80	85
Y	56	50	48	60	62	64	65	70	74	82	90

17. The below shows the number of deaths in Borno State for the year 2009 – 2015

Year	2009	2010	2011	2012	2013	2014	2015
Deaths	19.0	20.6	20.1	20.7	21.5	23.4	24.7

Use the table to construct a 5-year moving average

18. In an election, the probability that Mr. P, Mr. Q and Mr. R. win the election is: $\frac{1}{5}$, $\frac{1}{4}$ and $\frac{1}{3}$ respectively, calculate the probability that;

(a) Mr. Q did not win

(b) Mr. P or Mr. R wins.

19. A box contains 4 black and 6 white identical beads. If a girl picks two beads randomly one after the other with replacement. What is the probability that

i. The first bead is black and the second bead is white

ii. Both beads are of the same colour

iv. The first bead is white and the second is black

v. Both beads are of different colours

20. A box contains 4 black and 6 white identical beads. If a girl picks two beads randomly one after the other without replacement. What is the probability that:

vi. i. The first bead is black and the second bead is white?

vii. ii. The first bead is white and the second bead is black

viii. iii. Both beads are of the same colour?

ix. iv. Both beads are of different colours?

MODEL ANSWERS IN ALTERNATE SEQUENCE (ODD NUMBERS)

Question 1

Explain the Classification of Time-Series Movements

Answer:

Students are to give brief definition defining time series as an ordered sequence of values of a variable at equally spaced time intervals or a collection of observations of well-defined data items obtained through repeated measurements over time

The Characteristics of time series may be classified into four main types often called the components of a time series. They are

- Long-Time or Secular Movements: The general direction in which the graph of a time series appears to be going over a long interval of time.
- Cyclic Movements or Variations: These refer to the long-term oscillations, or swings, about a trend line or curve. These cycles, as they are sometimes called, may or may not

be periodic. They may or may not follow exactly similar patterns after equal intervals of time.

- Seasonal Movements or Variations: These refer to the identical or almost identical patterns that a time series appears to follow during corresponding months or quarters of successive years. Such movements are due to recurring events that take place annually, such as a sudden increase of department store sales before Christmas.
- Irregular or Random Movements: These refer to sporadic motions of time series due to chance events, such as floods, strikes, and elections. Although it is ordinarily assumed that such events produce variations lasting only a short time, they may be so intense as to result in a new cyclic or other movements

Question 3: Explain the following ways of estimating trends.

- i. The Free hand Method
- ii. The moving Average Method

Answer:

A trend can be estimated in any of several ways

- The Free hand Method: This method which consists of fitting a trend line or curve simply by looking at the graph, can be used to estimate trend. However, it has the obvious disadvantage of depending too much on individual judgment.
- The moving Average Method: By using moving average of appropriate orders, we can determine the trend movement. One advantage of this method is that the data at the beginning and end of a series are lost

Question 5: Calculate the coefficient of correlation from the following data between x and y.

X	1	3	4	7	10	12	13	14
Y	9	7	3	2	5	7	10	10

Answer:

$$r = \frac{n \sum yx - (\sum y) - (\sum x)}{(n \sum y^2 - (\sum y)^2 (n \sum x^2 - \sum x)^2)}$$

n = 8,
 $\sum x = 64,$
 $\sum y = 53,$
 $\sum x^2 = 684,$
 $\sum y^2 = 417,$
 $\sum xy = 460$
 Ans = 0.34

Question 7: Define correlation and explain its uses

Answer

- Correlation refers to the relationship of two variables more. It refers to a process for establishing whether or not relationships exist between two variables, e.g., relation

between height of father and son, yield and rainfall, wage and price index, share and debentures etc.

- Correlation is statistical Analysis which measures and analyses the degree or extent to which the two variables fluctuate with reference to each other.
- It expresses the inter-dependence of two sets of variables upon each other

The following are the uses of correlation

1. It is used in physical and social sciences.
2. It is useful for economists to study the relationship between variables like price, quantity etc. Businessmen estimates costs, sales, price etc. using correlation.
3. It is helpful in measuring the degree of relationship between the variables like income and expenditure, price and supply, supply and demand etc.
4. Sampling error can be calculated.
5. It is the basis for the concept of regression.

Question 9: Compute Spearman's rank correlation coefficient for these two variables of the scores of six selected officers in a job placement test in a bank

Name	Placement score x	Performance Score y
Jessica	92	84
Bolu-Martins	88	77
Melina	86	77
Priscilla	82	78
Ife	70	64
Emeka	96	88

Answer:

To compute r_s , first place the x-values in the rank order of their magnitudes and place the corresponding y-values opposite them.

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Where $d = r_x - r_y$ or $r_y - r_x$

x	Y	r_x	r_y	d = r_x-r_y	d²
92	84	2	2	0	0
88	77	3	4.5	-1.5	2.25
86	77	4	4.5	-0.5	0.25
82	78	5	3	2	4
70	65	6	6	0	0
96	88	1	1	0	0

$$\begin{aligned} \sum d^2 &= 6.5 \\ &= 1 - \frac{39}{6(36 - 1)} \end{aligned}$$

$$= 0.82$$

Question 11: The table below shows the respective heights X and Y of a sample of 12 fathers and their sons.

X of father	65	63	67	64	68	62	70	66	68	67	69	71
Y of son	68	66	68	65	69	66	68	65	71	67	68	70

Linear regression equation

$$a = \bar{y} + bX \dots\dots (1)$$

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum X)^2}$$

x	Y	x ²	xy	y ²
65	68	4225	4420	4624
63	66			
67	68			
64	65			
68	69			
62	66			
70	68			
66	65			
68	71			
67	67			
69	68			
71	70			
∑x= 800	∑y = 811	∑x² = 53, 418	∑xy= 54107	∑y² = 54849

Ans = 0.476

Question 13: A six-sided fair dice is rolled once. Find the probability that the side that shows up is

- (d) either a 1 or a 5
- (e) either an even number or an odd number
- (f) either an even number or a prime number

Answer

$$S = \{1, 2, 3, 4, 5, 6\}, n(S) = 6$$

$$(a) E_1 = \{1\}, n(E_1) = 1, E_2 = \{5\}, n(E_2) = 1$$

$$\Pr(E_1 \text{ OR } E_2) = \Pr(E_1) + \Pr(E_2) \text{ (mutually exclusive events)}$$

$$\text{So, } \Pr(E_1 \text{ OR } E_2) = \Pr(1 \text{ OR } 5)$$

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

$$= \frac{1}{3}$$

$$(b) E_1 \text{ (even numbers)} = \{2, 4, 6\}, n(E_1) = 3,$$

$$E_2 \text{ (odd numbers)} = \{1, 3, 5\}, n(E_2) = 3$$

$$\Pr(E_1 \text{ OR } E_2) = \Pr(E_1) + \Pr(E_2)$$

$$= \frac{3}{6} + \frac{3}{6}$$

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

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

$$= 1$$

(c) E_1 (even number) = {2, 4, 6}, $n(E_1) = 3$, $E_2 = \{2, 3, 5\}$, $n(E_2) = 3$

So $(E_1 \cap E_2) = \{2\}$, $n(E_1 \cap E_2) = 1$

and

$\Pr(E_1 \text{ OR } E_2) = \Pr(E_1) + \Pr(E_2) - \Pr(E_1 \text{ AND } E_2)$ (Mutually exclusive events)

So $\Pr(E_1 \text{ OR } E_2) = \Pr(\text{Even OR Prime})$

$$= \frac{3}{6} + \frac{3}{6} - \frac{1}{6}$$

$$= \frac{5}{6}$$

Question 15: Calculate coefficient of correlation from the following data.

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

Answer

$$\sum x = 45$$

$$\sum y = 108$$

$$\sum x^2 = 285$$

$$\sum y^2 = 1356$$

$$\sum xy = 597$$

$$9 \times 597 - 45 \times 108$$

$$\sqrt{(9 \times 285 - (45)^2) \cdot (9 \times 1356 - (108)^2)}$$

$$= 0.95$$

Question 17: The below shows the number of deaths in Borno State for the year 2009 – 2015

Year	2009	2010	2011	2012	2013	2014	2015
Deaths	19.0	20.6	20.1	20.7	21.5	23.4	24.7

Use the table to construct a 5-year moving average

Answer:

Year	Data	5 – Year Moving Total	5-Year Moving Average
2009	19.0		
2010	20.6		
2011	20.1	101.9	20.38
2012	20.7	106.3	21.26
2013	21.5	110.4	22.08
2014	23.4		
2015	24.7		

Question 19 A box contains 4 black and 6 white identical beads. If a girl picks two beads randomly one after the other with replacement. What is the probability that

- i. The first bead is black and the second bead is white
- ii. Both beads are of the same colour
- iii. The first bead is white and the second is black
- iv. Both beads are of different colours

Answer:

- Given that blue = 4 and white = 6.

- i. The first bead is black and the second bead is white

$$\begin{aligned}
 \Pr(\text{black then white}) &= \Pr(\text{black AND white}) \\
 &= \Pr(\text{black}) \times \Pr(\text{white}) \\
 &= \frac{4}{10} \times \frac{6}{10} = \frac{2}{5} \times \frac{3}{5} \\
 &= \frac{6}{25}
 \end{aligned}$$

- ii. Both beads are of the same colour

$$\begin{aligned}
 &\Pr(\text{both same colour}) \\
 &= \Pr(\text{black and black}) \text{ OR } \Pr(\text{white and White}) \\
 &= \Pr(\text{black} \times \text{black}) + \Pr(\text{white} \times \text{white}) \\
 &= \left(\frac{4}{10} \times \frac{4}{10}\right) + \left(\frac{6}{10} \times \frac{6}{10}\right) \\
 &= \frac{2}{5} \times \frac{2}{5} + \left(\frac{3}{5} + \frac{3}{5}\right) \\
 &= \frac{4}{25} + \frac{9}{25} \\
 &= \frac{13}{25}
 \end{aligned}$$

- iii. The first bead is white and the second is black

$$\begin{aligned}
 &= \Pr(\text{white then black}) \\
 &= \Pr(\text{white AND black}) \\
 &= \Pr(\text{white}) \times \Pr(\text{black}) \\
 &= \frac{6}{10} \times \frac{4}{10} \\
 &= \frac{3}{10} \times \frac{2}{5} \\
 &= \frac{6}{25}
 \end{aligned}$$

- iii. Both beads are of different colours

Pr (different colour)

$$\begin{aligned}
 &= \Pr(\text{black AND white}) \text{ OR } \Pr(\text{white AND black}) \\
 &= \Pr(\text{black}) \times \Pr(\text{white}) + \Pr(\text{white}) \times \Pr(\text{black}) \\
 &= \left(\frac{4}{10} \times \frac{6}{10}\right) + \left(\frac{6}{10} \times \frac{4}{10}\right) \\
 &= \left(\frac{2}{5} \times \frac{3}{5}\right) + \left(\frac{3}{5} \times \frac{2}{5}\right) \\
 &= \frac{6}{25} + \frac{6}{25} \\
 &= \frac{12}{25}
 \end{aligned}$$