GREAT ZIMBABWE UNIVERSITY

HSOR 226

NATURAL SCIENCES

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

BSc Honors in Mathematics: Part 2 Semester 1

EXAMINATION:

HSOR 226: BUSINESS STATISTICS

DATE:

Time: 3 hours

Candidates may attempt all questions in Section A and any two questions from Section B.

All questions in Section B carry equal marks.

SECTION A

Answer ALL questions [40 MARKS]

A1. Last year, 70% of total student applications received by the Zimbabwe Open University were from female applicants. Out of a random sample of 150 applications received this year, 90 were from females. Test the hypothesis that the proportion of applications from females has not changed using a 10% level of significance. [10]

A2. In a survey of 300 company executives carried out by the Zimbabwe Congress of Trade Unions (ZCTU), 81 executives said they are willing to publicly disclose their annual salaries. Find a 99% confidence interval for the proportion of all executives who are Willing to disclose their annual salaries. [10]

A3. The average time that Athletes spent to complete a given race is claimed to be 40 minutes. A random sample of 10 girls was taken from the whole group had their times recorded as follows:

43 38 40 45 36 34 50 37 48 42

Test the claim using a 1% level of significance. [10]

A4. A bicycle manufacturing company in Zimbabwe is normally distributed with a mean of 700 bicycles sold per month and standard deviation of 6 bicycles. What is the probability that:

(a) at most 600 bicycles will be sold in one month, [5]

(b) between 600 and 700 bicycles will be sold in one month. [5]

SECTION B

Answer ANY TWO questions [60 MARKS]

B5. A money market analyst would like to estimate the relationship between annual incomes Of families and their annual savings. The following data was obtained.

Table 1: Family income and savings data.

Annual income($000s)	15	12	18	10	16	13	20	19	15
Annual Savings($000s)	3.5	2.1	3.8	0.9	3.9	2.6	5.0	4.2	4.5

(a) State the independent and dependent variable. [2]

(b) Obtain the least squares regression equation connecting income and savings. [8]

(c) State three assumptions made when estimating the equation in (b) above. [5]

(d) Interpret the slope of the estimated regression equation. [2]

(e) Estimate the amount of annual savings for a family with an annual income of $14 000. [2]

(f) Test at 5% level of significance, whether annual income and annual savings are Correlated. [11]

B6. A local church organisation recorded the following quarterly amounts (in 000s) of tithes paid by its members for the period 2019 to 2021.

Table 2: Quarterly sales

Year	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
2019	100	120	132	110
2020	125	156	168	130
2021	141	164	180	200

(a) Draw a time series chart of the data and comment on the trend and seasonal components. [6]

(b) Obtain a centered 4-point MA of the series and use it to calculate adjusted seasonal indexes for the data. [10]

(c) Find the deseasonalised series of the data. [6]

(d) Forecast the quarterly amounts of tithes for the year 2022. [8]

B7. Table 1 below gives observations on systolic blood pressure and age for a sample of eight individuals.

(note $\overline{y}$ = 149.00, $\bar{x}$ = 44, S_{xx} = 1556.00, S_{yy} = 7224.00, and S_{xy} = 1692)

Table 1: Systolic blood pressure and age data.

Bp (y)	116	138	132	162	154	220	128	142
Age (x)	20	45	29	67	56	47	38	50

(a) Discuss the assumptions that must be met before carrying out a regression analysis? [4]

(b) Find the least squares estimates of β0 and β1. Write down the equation of the Regression line. [4]

(c) Give the analysis of variance table for the regression model and test the significance Of the regression line using the *F* test at α = 0.05. [12]

(d) What systolic blood pressure would you expect for age 28? [2]

(e) Test at 5% level of significance, whether bp and age are correlated. [8]

END OF QUESTION PAPER