UNIVERSITY OF SWAZILAND

RE-SIT/SUPPLEMENTARY EXAMINATION PAPER 2016

TITLE OF PAPER	:	DESCRIPTIVE STATISTICS
COURSE CODE	:	STA131/IDE-ST 132
TIME ALLOWED	:	TWO (2) HOURS
REQUIREMENTS	:	CALCULATOR
INSTRUCTIONS	:	THIS PAPER HAS FIVE (5) QUESTIONS. ANSWER ANY FOUR (4) QUESTIONS.

Question 1 [25 marks, 10+2+7+3+3]

(a) The data in the table below show quarterly house sales in a region of Scotland for 22 successive quarters. The table also shows the appropriate centred moving average.

(i) Calculate the missing values shown as a, b and c.

(ii) Without doing any calculations, describe the variation shown in the data across the four quarters of the year.

(iii) Calculate the seasonal factors. Do seasonal forces significantly influence sales? Comment.

Quarter	Sales				Moving average
1	207				
2		223			
3			364		286.375
4				355	294.25
1	200				306.25
2		293			a
3			390		331.875
4				399	358
1	291				381.75
2		411			409.25
3			462		429
4				547	423.625
1	b				421.5
2		358			416.25
3			498		405.625
4				469	419.75
1	294				436.5
2		478			437.75
3			512		437.75
4				465	c
1	298				
2		337			

(b) The table shows the average price, in pence, of a litre of petrol in Swaziland on 31 December each year from 2003 to 2011.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Price (c)	76.02	84.17	87.35	85.47	102.13	92.79	108.73	119.21	133.38

(i) Calculate the percentage change in the price of petrol from the previous year, for the years to December 2005 and December 2008.

(ii) Taking 2003 as base year, express the price of petrol in 2004 and 2011 as index numbers.

Question 2 [25 marks, 6+6+8+5]

(a) A company wishes to measure the change in its performance using an index calculated from the data given below on numbers of times sold and their prices in 1990 and 1991.

	1990		1991	
Item	Price	Number	Price	Number
A	2.50	90	2.70	200
B	3.80	150	4.00	160
C	4.10	180	4.50	120

Use 1990 as base and calculate for 1991:

(i) the Laspeyres quantity index;

(ii) the simple aggregate quantity index.

(b) The number of senior civil servants (a random sample) who joined work before 8:45 am, almost every day, was recorded as follows:

17 17 18 18 18 19 20 21 22 24
24 25 25 26 26 27 27 27 27 28

(i) Calculate the coefficient of skewness.

(ii) Estimate the interquartile range.

Question 3 [25 marks, 8+6+6+5]

(a) It is believed that the price of a house in a certain city may be related to its distance from the centre of the city. These distances (in kilometres) can easily be obtained from a map and are given below for the 12 houses in the sample.

House	A	B	C	D	E	F	G	H	I	J	K	L
Price (SZL 000)	63	75	59	75	100	108	100	90	70	96	84	100
Distance	5.5	5.7	5.2	4.9	3.3	2.1	2.2	3.1	4.2	3.1	3.5	2.8

(i) Using least squares, find the regression coefficients of house price on distance from the city centre. Explain to a manager, with no statistical knowledge the meaning of the terms: slope, intercept and coefficient of determination.

(ii) The overall average distance from the city centre is 4.5 kilometres. Use this information to estimate the population mean house price..

(iii) Comment on the advantages of using linear regression for forecasting and the limitations of the technique.

(b) The summary statistics for two data sets are as follows:

	Sample size	Sample mean
X data	19	7.0
Y data	25	5.1

Compute the mean of the combined data sets.

Question 4 [25 marks, 4+4+4+8+5]

(a) A fish shop owner recorded the daily turnover of his outlet for 300 trading days as shown in the following table.

Daily turnover	Number of days
$500- < 750$	15
$750- < 1000$	23
$1000- < 1250$	55
$1250- < 1500$	92
$1500- < 1750$	65
$1750- < 2000$	50

(i) Compute and interpret the average *daily turnover* of the fish shop.

(ii) Find the median daily turnover of the fish shop. Interpret its meaning.

(iii) Identify the maximum daily turnover associated with the slowest 25% of trading days.

(iv) Compute the coefficient of skewness and interpret its meaning.

(b) In the UK Index of Retail Prices for December 1986 (January 1974=100) the approximate index for beer was around 500 and that for cheese was 400. Consider the following statements about December 1986:

(i) The price of beer was lower than the price of cheese.

(ii) The price of beer was higher than the price of cheese.

(iii) The change in the price of beer was 20 percent greater than the change in the price of cheese since January 1974.

Which of the statement(s) is/are true?

Question 5 [25 marks, 5+5+5+5+5]

A police officer classifies a total of 150 reported crimes in 2009 by age (in years) of the criminal and whether the crime is violent or non-violent.

	Age (in years)		
Type of crime	**Under 20**	**20 to 40**	**Over 40**
Violent	27	41	14
Non-violent	12	34	22

You must define the respective event(s) in each case and must use one of the probability rules to compute the following probabilities:

(a) What is the probability of selecting a case to analyse and finding it involved a violent crime?

(b) What is the probability of selecting a case to analyse and finding the crime was committed by some one 40 or less than 40 years old?

(c) What is the probability of selecting a case that involved a violent crime or an offender less than 20 years old?

(d) Given that a violent crime is selected for analysis, what is the probability the crime was committed by a person under 20 years old?

(e) Two crimes are selected for review by a Judge. What is the probability that both are violent crime?

Multiplication rule *Statistically dependent events*

$P(A \cap B) = P(A/B) \times P(B)$ 4.5

Statistically independent events

$P(A \cap B) = P(A) \times P(B)$ 4.6

$n!$ = n factorial $n \times (n-1) \times (n-2) \times (n-3) \times \ldots \times 3 \times 2 \times 1$ 4.8

Permutations $_nP_r = \frac{n!}{(n-r)!}$ 4.10

Combinations $_nC_r = \frac{n!}{r!\,(n-r)!}$ 4.11

PROBABILITY DISTRIBUTIONS

Binomial distribution $P(x) = {_nC_x}\, p^x (1-p)^{(n-x)}$ for $x = 0, 1, 2, 3, \ldots, n$ 5.1

$P(x \text{ successes}) = \frac{n!}{x!\,(n-x)!}\, p^x (1-p)^{(n-x)}$ for $x = 0, 1, 2, 3, \ldots, n$

Binomial descriptive measures Mean $\mu = np$

Standard deviation $\sigma = \sqrt{np(1-p)}$ 5.2

Poisson distribution $P(x) = \frac{e^{-a} a^x}{x!}$ for $x = 0, 1, 2, 3 \ldots$ 5.3

Poisson descriptive measures Mean $\mu = a$

Standard deviation $\sigma = \sqrt{a}$ 5.4

Standard normal probability $z = \frac{x-\mu}{\sigma}$ 5.6

INDEX NUMBERS

Price relative Price relative $= \frac{p_1}{p_0} \times 100\%$ 13.2

Laspeyres price index *Weighted aggregates method*

Laspeyres price index $= \frac{\Sigma(p_1 \times q_0)}{\Sigma(p_0 \times q_0)} \times 100\%$ 13.5

Laspeyres price index *Weighted average of relatives method*

Laspeyres price index $= \frac{\Sigma\left[\left(\frac{p_1}{p_0}\right) \times 100 \times (p_0 \times q_0)\right]}{\Sigma(p_0 \times q_0)}$ 13.9

Paasche price index *Weighted aggregates method*

$= \frac{\Sigma(p_1 \times q_1)}{\Sigma(p_0 \times q_1)} \times 100\%$ 13.8

Paasche price index *Weighted average of relatives method*

$= \frac{\Sigma\left[\left(\frac{p_1}{p_0}\right) \times 100 \times (p_0 \times q_1)\right]}{\Sigma(p_0 \times q_1)}$ 13.10

Quantity relative Quantity relative $= \frac{q_1}{q_0} \times 100\%$ 13.11

Laspeyres quantity index *Weighted aggregates method*

Laspeyres quantity index $= \frac{\Sigma(p_0 \times q_1)}{\Sigma(p_0 \times q_0)} \times 100\%$ 13.12

Laspeyres quantity index *Weighted average of relatives method*

Laspeyres quantity index $= \frac{\Sigma\left[\left(\frac{q_1}{q_0}\right) \times 100 \times (p_0 \times q_0)\right]}{\Sigma(p_0 \times q_0)}$ 13.14