SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Information Technology

First Year, Second Semester Examination – 2018

HNDIT1214 – Statistics for IT-ANSWERS

Instructions for Candidates:

Answer 04 questions in only

Non Programmable calculators are allowed

No. of questions: 06

No. of pages : 05

Time : **02 hours**

Question 01. (**Total 25 marks**)

(i) Read the following information about grade 10 student result and attendance average for 04 months in Royal School

Month	Class attendance average	No of student who pass the monthly test
January	60.3%	70
Febuary	80.5%	85
March	50.5%	45
April	70.3%	65

a) What are the variables under study? (03 marks)

Month, Class attendance average, No of student who pass the monthly test

b) Are descriptive, inferential, or both types of statistics used? (01 mark)

Descriptive Statistics

c) Categorize each variable as quantitative or qualitative. (03 marks)

Quantitative: Class attendance average, No of student who pass the monthly test

Qualitative: Month

d) Categorize each quantitative variable as discrete or continuous. (02 marks)

Discrete: No of student who pass the monthly test

Continuous: Class attendance average

e) Identify the level of measurement for each variable. (03 marks)

Month: Nominal

Class attendance: ratio

No of student who pass the monthly test: ratio

f) From the information given, comment on the relationship between the variables.

When class attendance is increasing, number of pass students are increasing

(01 marks)

(ii) The data shown here represent the number of Km per day that 30 selected runners are running in a city

11 17 12 14 16 18 16 18 12 16 17 15 15 16 12

21 16 16 12 14 15 12 15 15 19 13 16 18 16 14

a) State advantages of visualizing data? (01 marks)

- *It's difficult to see what's really going on just by looking at the raw data. Graphs provides the solution to it.*
- *There can be patterns and trends in the data, but these can be very hard to spot if you're just looking at a heap of numbers*
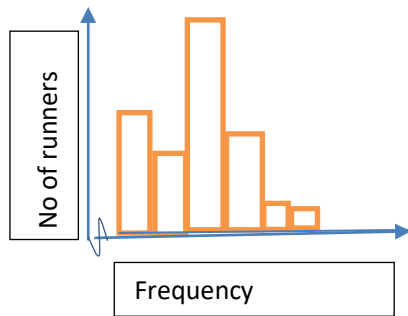- *Other reasonable answers*

b) Construct a frequency distribution by selecting class width as 2 (02 marks)

(01 mark for class limits, 02 marks for tally/frequency)

Class limits	Class boundaries	Tally/frequency
11-12	*10.5-12.5*	*06*
13-14	*12.5-14.5*	*04*
15-16	*14.5-16.5*	*13*
17-18	*16.5-18.5*	*5*
19-20	*18.5-20.5*	*1*
21-22	*20.5-22.5*	*1*

c) Represent a histogram for the above data (06 marks)

(iii) In year 2018, a student has bought 10 novels. In each year, this student will expect to buy two novels more than the number of novels available with him in previous year. Express the sigma notation to calculate the number of total novels available with him in year 2050.

$$\sum_{k=0}^{32} (10+2k)$$

(03 marks)

Question 02. (Total 25 marks)

(i) The profit level of 50 companies in electronic industry are shown in below table.

profit	frequency
-2 and under 0	4
0 and under 2	11
2 and under 4	17
4 and under 6	12
6 and under 8	4
8 and under 10	2

(ii) To analyse the values in the above table

    a. State down two type of measures of central location (02 marks)

    Mean, Median, Mode, Quartile

    b. State down two type of measures of dispersion (02 marks)

    Standard deviation, Quartile deviation, variance

(iii)   Find

a. Mean (03 marks)

Profit	Frequency(f)	Class mid poind (x)	fx	cf
-2 and under 0	4	-1	-4	4
0 and under 2	11	1	11	15
2 and under 4	17	3	51	32
4 and under 6	12	5	60	44
6 and under 8	4	7	28	48
8 and under 10	2	9	18	50
	50		**164**	

Class mod point calculation ………….. (01 mark)
fx calculation ………………………….(01 mark)
∑fx/f=164/50 = 3.28………………… (01 mark)

b. Median

(03 marks)

$$\text{Median} = L + \left[\left(\frac{n}{2} - CF \right) \Big/ f \right] i$$

L- is the lower limit of the median class,
CF- is the cumulative frequency preceding the median class,
f - is the frequency of the median class, and
i - is the median class interval.

Equation:……. 01 marks

Median profit limit $(50/2)^{th}$ item= median class (2 and under 4)

Median=2+[25-15]*2/17=3.17 **Substitute……. 01 marks**
                           Final answer……. 01 marks

c. Mode (03 marks)

$$Mode = L_{mo} + \left[\frac{D_a}{D_b + D_a} \right] (C)$$

L_{mo} is the lower boundary of the modal class
D_a is the difference between the frequency of the modal class and the class preceding it

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D_b *difference between the frequency of the modal class and the class after it*

D_b *difference between the frequency of the modal class and the class after it*
C *is the class interval of the modal class*

Equation (01 mark)
=2+[6/11]*2=3.09 Substitution ……(01 mark) final answer ……..01 marks

d. 1st 2nd and 3rd Quartile deviations   (06 marks)

$$Q_1 = L + \frac{\left(\frac{n}{4} - CF\right)}{f} \ (i)$$

L=lower limit of the class containing Q1,
CF= cumulative frequency preceding class containing Q1,
f= frequency of class containing Q1,
i= size of class containing Q1.
Q₁= 1.54 (01 mark for equation, 02 marks for substitute and answer)

$Q_1 = 1.54$ *(01 mark for equation, 02 marks for substitute and answer)*
Q2= Median (02 marks)
Q3=4.8 (01 mark for equation, 02 marks for substitute and answer)

e. variance   (03 marks)

$$S^2 = \frac{\Sigma f M^2 - n\overline{X}^2}{n - 1}$$

Equations……………….01 mark

Profit	Frequency(f)	Class mid poind (x)	fx	Fx^2	cf
-2 and under 0	4	-1	-4	4	4
0 and under 2	11	1	11	11	15
2 and under 4	17	3	51	153	32
4 and under 6	12	5	60	300	44
6 and under 8	4	7	28	196	48
8 and under 10	2	9	18	162	50
	50		**164**	**826**	

Fx^2 calculation ……………….01 mark

Varience =[826-50*(3.28)^2]/49= 5.87 ………………………01 mark

$$S = \sqrt{S^2} = 2.41$$

(iv)   The salaries in descending order for the staff of ABC Manufacturing Co. are shown here.

Staff	Salary in Rs

Manager	30000
Engineer	25000
System analyst	x
Technician	15000
Receptionist	12000
Driver	y

a) This company has to pay Rs 19,000 average and Rs 20,000 median salary for the staff. Calculate Driver salary and Receptionist salary (03 marks)

(30,000+25000+x+15000+12000+y)/6=19000   x+y=32000 …...(01 mark)

20,000=(x+15000)/2   x=25000……………………………………(01 mark)

y =7000 …………………………………………………………(01 mark)

Question 03. (Total 25 marks)

(i) What is the difference in between "Permutation" and combination (02 marks)

*A permutation is an arrangement of n objects in a **specific order.***
*A selection of distinct objects **without regard to order** is called a combination.*

(ii) A team leader in a musical team of 10 players want to select 2 musical players to present a TV program.

    a) How many different possibilities are there without any priority? (02 marks)
    $^{10}C_2 = 10! / (8!*2!)= 45$

    b) One will be presented in the morning program, and one will be presented in the evening program. How many different possibilities are there to present them for TV programs? (02 marks)
    $^{10}P_2 = 90$

    c) Each week, the team leader must send 2 players to the TV program. One player is selected for the TV program and this player resigns from the team. How many different ways to select the players for the TV program in 3rd and 4th weeks?

$$4^{th} \text{ week} = {}^7C_2, \quad 7!/(5!*2!) = 42 \quad (03 \text{ marks})$$ (03 marks)

d) Each week, the team leader must send 2 players to the TV program. One player is selected for the TV program and this player resigns from the team. In next week, the leader give a priority to send the player who was unable to select in previous week. How many different ways to select the players for the TV program in 3rd and 4th weeks?

(03 marks)

$$4^{th} \text{ week} = {}^6C_1 = 6!/5! = 6$$

(iii) A particular cell phone company offers 4 models of phones, each in 6 different colours and each available with any one of 5 calling plans.

a) How many combinations of colours and calling plans are possible to model one cell phone?

6*5=30 (02 marks)

b) The manufacture has to select 3 colours and 5 calling plans to model a phone. How many combinations of colours and calling plans are possible to model one cell phone?

${}^6C_3*5=20*5 =100$ (03 marks)

(iv) How many different ways can 5 people—Rosi, Kamal, Sarth, Kumara, and Janith sit in a row at a class, if

a) Rosi and Kamal must sit together; ………………………………… (02 marks)

4!*2

b) Rosi in first place in the row and janith in last place of the row ………..(02 marks)

3!=6

c) Rosi and Janith will not sit next to each other? ………………………...(02 marks)

5!-4!*2!

d) Rosi and Janith will not sit next to each other? …………………… (02 marks)

5!-4!*2!

Question 04. (Total 25 marks)

(i) State what is meant by two events being statistically independent ………(02 marks)

Two events are independent if the outcome of one event makes no difference to the outcome of the other event.

(ii) Give an example for mutual exclusive event ……………………………….(01 marks)

Tossing a coin: getting Heads and Tails in same experiment

Rolling a dice: getting one and two in same experiment

(iii) A garment factory which employees 10,000 men, 1% of all employees have a minor accident in a given year. *Of these, 40%* had safety instructions whereas *90% of all employees* had no safety instructions.

   a) Calculate number of accidents in a given year

   1% from 1000 = 100   (01 marks)

   b) Calculate no of employees who had not safety instructions   (01 marks)

   =10,000*90/100=9000

   c) Fill the following table according to the above information

	Safety instructions	No safety instruction	**Total**
Accident	100*40/100=40 (01 mark)	60 (01 mark)	100
No Accident	960 (01 mark)	8940 (01 mark)	9900 (01 mark)
Total	1000 (01 mark)	9000	10000 (01 mark)

(07 marks)

   d) What is the probability of an employee being accident-free, given that he had not safety instructions   (02 marks)

   P(Accident free/no safety instructions)=8940/9000=0.99
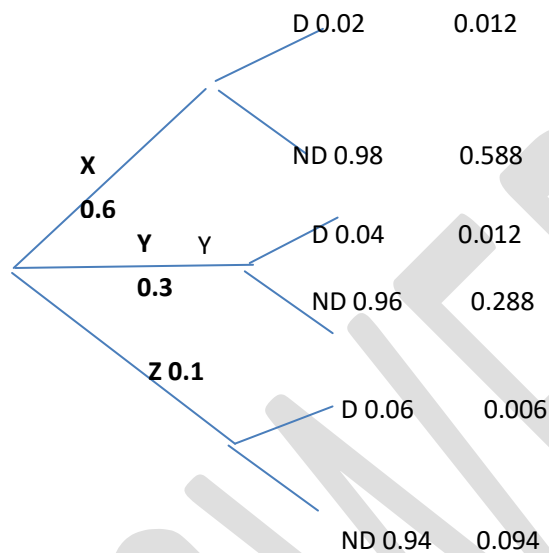
   e) What is the probability of an employee being accident-free, given that he had safety instructions   (02 marks)

   P(Accident free/safety instructions)=960/1000=0.96

(iv) Three machines produce, X, Y and Z produce 60%, 40% and 20% respectively, of the total production. The percentage of defective production of the machines are 1%, 2% and 3% respectively.

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a) Draw a tree diagram to illustrate above all outcome of X,Y and Z machine

…………………………………………………………………(03 marks)

D 0.02   0.012

ND 0.98   0.588

X

0.6

Y   Y   D 0.04   0.012

0.3

ND 0.96   0.288

Z 0.1

D 0.06   0.006

ND 0.94   0.094

b) If an item is selected is at random Find the probability that the item is

defective ……………………………………………………………….(02 marks)

P(D)= 0.012+0.012+0.006=0.03

c) Assuming an item is selected at random is found to be defective ,find the

probability that the item was produced on machine X……………...(01 mark)

P(X/D)=0.012

d) If item is found to be defective, find the probability that the item was made by

machine X……………………………………………………………...(03 marks)

P(X/D)=P(XD)/P(D)=0.012/0.03=0.4

Question 05. (Total 25 marks)

(i) What is meant by discrete probability distribution   (02

marks)

A discrete distribution describes the probability of occurrence of each value of a discrete random variable.

(ii) A baseball team from Sri Lanka played 40 games for the International Competitions in 2018 and team won number of games with medals 4, 5, 6 and 7. The data shown consist of the number of medals and number of games that the team got relevant medals in competition.

No of medals (X)	4	5	6	7
No of Games	8	7	9	16

a) Find the probability P(X) for each X and construct a probability distribution a (02 marks)

No of medals (X)	4	5	6	7
No of Games	8	7	9	16
P(X)	0.200	0.175	0.225	0.400

b) Draw a graph to represent P(x) for the above data.(02 marks)
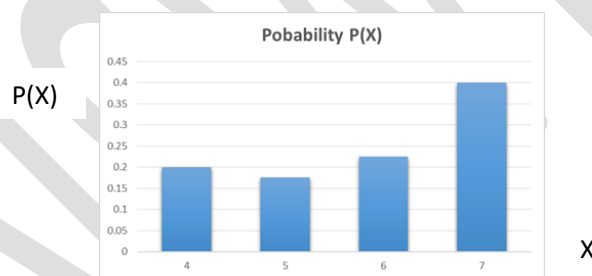
c) Find the probability of number of games that team won more than 5 medals (03 marks)

P(x>=6)=0.225+0.400=0.625

d) Find the expected value and variance (06 marks)

No of medals (X)	4	5	6	7
No of Games	8	7	9	16
P(X)	0.200	0.175	0.225	0.400
xP(x)	0.8	0.875	1.35	2.8

E(X)=∑xp(x)=5.825………………………….(02 marks)

Varience=∑(x-μ)²p(x)………………………. (01 mark)

$$=(-1.8)^2*0.8+(-0.8)^2*0.875+0.2^2*1.35+1.2^2*2.8\ldots\ldots.(02\ marks)$$

$$=7.72\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(01\ mark)$$

(iii) If a factory produces electronic items with defective rate of 10% and samples of 5 are taken from the production

    a) State probability distribution function for the probability of k success in n trials and probability p of success on a given trial.   (02 marks)

$$P(x=k) = C_k^n p^k q^{n-k} = \frac{n!}{k!(n-k)!} p^k q^{n-k} \text{ for } k = 0,1,2,\ldots n.$$

$$\text{Recall} \quad C_k^n = \frac{n!}{k!(n-k)!}$$

with $n! = n(n-1)(n-2)\ldots(2)1$ and $0! \equiv 1$.

    b) Find the probability of one item is defective (02 marks)

$$P(x=1)=C_1^5 (0.1)^1*(0.9)^4=5*0.1*0.66=0.328$$

    c) Find the probability of at least one item is defective (03 marks)

$$P(X>=1)= 1-P(x=0)=1-C_0(0.1)^0*(0.9)^5=1-0.59=0.41$$

    d) Find the probability that the defective item is between 2 and 4 (03 marks)

$$P(1<x<5)={}^5C_2(0.1)^2(0.9)^3+{}^5C_3(0.1)^3(0.9)^2+{}^5C_4(0.1)^4(0.9)^1$$

$$= 0.0729+0.0081+0.0009$$

$$=0.0819$$