INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	April 2018
Programme	:	Foundation In Science (CFSI)
Course	:	**STA1202: Statistics**
Date of Examination	:	2nd August 2018 (Thursday)
Time	:	11:00am – 01:00pm Reading Time : Nil
Duration	:	2 Hours

Special Instructions :

This paper consists of **SIX (6)** questions. Answer any **FIVE (5)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Formula Booklet 1, Graph Paper

Examiner(s) : **Ms. Ng Ci Xiang**

Moderator : **Dr. Ch'ng Pei Eng**

This paper consists of 8 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

FOUNDATION IN SCIENCE (CFSI)
STA1202: STATISTICS
FINAL EXAMINATION: APRIL 2018 SESSION

Instruction: This paper consists of **SIX (6)** questions. Answer any **FIVE (5)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Events A and B are such that $P(A) = 0.3$, $P(B) = 0.8$ and $P(A \text{ and } B) = 0.4$. State, giving a reason in each case, whether events A and B are

(i) independent, (2 marks)

(ii) mutually exclusive. (2 marks)

(b) The manager of a company noted the times spent in 80 meetings. The results were as follows.

Time (t minutes)	$0 < t \leq 15$	$15 < t \leq 30$	$30 < t \leq 60$	$60 < t \leq 90$	$90 < t \leq 120$
Number of meetings	4	7	24	38	7

(i) Find the values of $\sum fx$ and $\sum fx^2$. (4 marks)

(ii) Find mean and variance. (3 marks)

(iii) Calculate the median by using the formula:

$$m = L_m + \left[\frac{\frac{1}{2}\left(\sum f\right) - F_{m-1}}{f_m}\right]c$$ (4 marks)

(c) The arrivals of patients at the casualty department of a hospital occur at random at an average rate of 6 per hour. Find the probability that,

(i) there are exactly 5 patients arrive in one hour. (2marks)

(ii) there are more than one patient arrives the casualty department in a period of 20 minutes. (3 marks)

Question 2

(a) For each of the following variables, state whether it is a discrete or a continuous variable.

(i) The time taken to mark a certain set of examination paper. (1 mark)

(ii) The number of doctors in Penang General Hospital. (1 mark)

(b) (i) The height of sunflowers follows a normal distribution with a mean 112 cm and a standard deviation 17.2 cm. Find the probability that the height of a randomly chosen sunflower is greater than 120 cm. (3 marks)

(ii) When a new fertilizer is used, the height of sunflowers follows a normal distribution with mean 115 cm. Given that 80% of the heights are now greater than 103 cm, find the standard deviation. (4 marks)

(c) A bag contains 4 white marbles and 3 blue marbles. Two marbles are drawn at random from the bag.

(i) Draw a tree diagram to show all the possible outcomes. (4 marks)

(ii) Find the probability that one marble of each colour is drawn. (3 marks)

(iii) Given that the 2nd marbles drawn is blue. Find the probability that the 1st marble is also blue. (4 marks)

Question 3

(a) Two fair dice are thrown. Let the random variable X be the smaller of the two scores if the scores are different, or the score on one of the dice if the scores are the same.

(i) Copy and complete the following possibility space diagram. (3 marks)

Dice 1 / Dice 2	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

(ii) Based on the results in (i), copy and complete the following probability distribution table of X. (3 marks)

x	1	2	3	4	5	6
$P(X = x)$						

(iii) Find $E(X)$. (2 marks)

(iv) Find $P(X < E(X))$. (2 marks)

(b) Melons are sold in three sizes: small, medium and large. The weights follow a normal distribution with mean 450 grams and standard deviation 120 grams. Melons weighing less than 350 grams are classified as small.

(i) Find the probability of a randomly selected melon which weigh less than 400 grams. (2 marks)

(ii) Find the proportion of melons which are classified as small. (3 marks)

(iii) The rest of the melons are divided in equal proportions between medium and large. Find the weight above which melons are classified as large. (5 marks)

Question 4

(a) A shop sells old video tapes, of which 1 in 5 on average are known to be damaged.

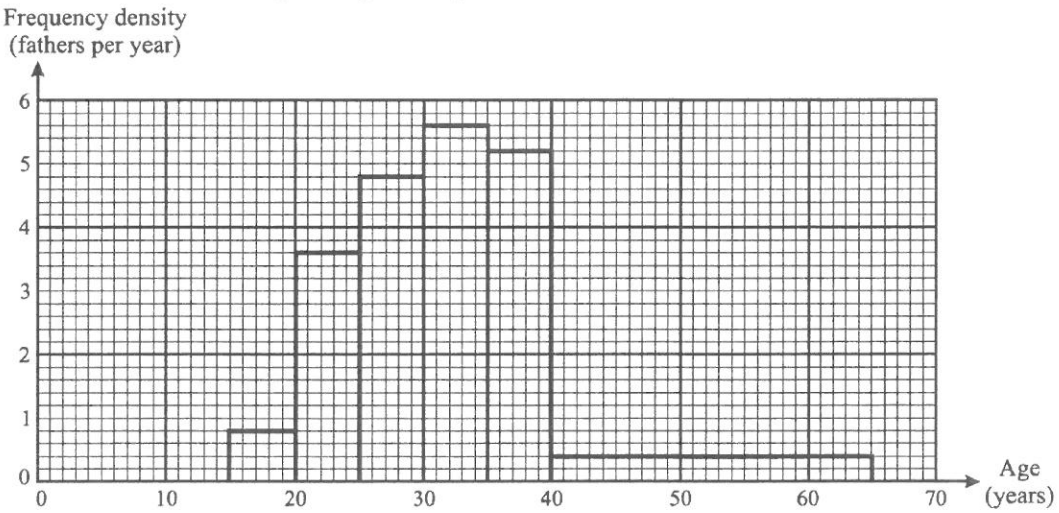
(i) A random sample of 10 tapes is taken. Find the probability exactly 4 are damaged. (2 marks)

(ii) Another random sample of 15 tapes is taken. Find the probability that at most 2 are damaged. (3 marks)

(iii) State the value of $E(X)$ and $VAR(X)$ when the size of a random sample is 20. (2 marks)

(iv) Find the smallest value of n if there is a probability of at least 0.85 that a random sample of n tapes contains at least one damaged tape. (3 marks)

(b) Each father in a random sample of fathers was asked how old he was when his first child was born. The following histogram represents the information.



(i) Copy and complete the table below. (6 marks)

Class boundaries	width	Frequency density	Frequency
15 – 20			
20 – 25			
:			
:			

(ii) How many fathers were in the sample? (1 mark)

(iii) Find the probability that a father, chosen at random from the group, was between 25 and 30 years old when his first child was born, given that he was older than 25 years. (3 marks)

Question 5

(a) A box of biscuits contains 50 biscuits, some of which are wrapped in gold foil and some of which are unwrapped. Some of the biscuits are chocolate-covered. 32 biscuits are wrapped in gold foil, and of these biscuits, 8 are chocolate-covered. There are 19 chocolate-covered biscuits in total.

(i) Copy and complete the table below to show the number of biscuits in each category. (4 marks)

	Wrapped in gold foil	Unwrapped	Total
Chocolate-covered			
Non chocolate-covered			
Total			50

(ii) A biscuit is selected at random from the box. Find the probability that the biscuit is chocolate-covered. (1 mark)

(iii) The biscuit is returned to the box. An unwrapped biscuit is then selected at random from the box. Find the probability that the biscuit is non chocolate-covered. (4 marks)

(iv) The biscuit is returned to the box. A biscuit is then selected at random from the box. Find the probability that the biscuit is wrapped, given that it is non chocolate-covered. (4 marks)

(b) At a certain airfield planes land at random times at a constant average rate of one every 10 minutes.

(i) Find the probability that exactly 5 planes will land in a period of one hour. (2 marks)

(ii) Find the probability that at least 2 planes will land in a period of 16 minutes. (3 marks)

(iii) State the value of mean and variance of the planes land in a period of 45 minutes. (2 marks)

Question 6

(a) As part of a data collection exercise, members of a certain school year group were asked how long they spent on their Mathematics homework during one particular week. The times are given to the nearest 0.1 hour. The results are displayed in the following table.

Time spent (t hours)	$0.1 \leqslant t \leqslant 0.5$	$0.6 \leqslant t \leqslant 1.0$	$1.1 \leqslant t \leqslant 2.0$	$2.1 \leqslant t \leqslant 3.0$	$3.1 \leqslant t \leqslant 4.5$
Frequency	11	15	18	30	21

(i) Draw, on graph paper, a histogram to illustrate this information. (5 marks)

(ii) Calculate an estimate of the mean and the variance for the time spent on their Mathematics homework by members of this year group. (5 marks)

(b) The probability that the school bus is on time on any particular day is 0.6. If the bus is on time the probability that Sam the driver gets a cup of coffee is 0.9. If the bus is not on time the probability that Sam gets a cup of coffee is 0.3.

(i) By using a tree diagram, or otherwise, find the probability that Sam gets a cup of coffee. (2 marks)

(ii) Given that Sam does not get a cup of coffee, find the probability that the bus is not on time. (3 marks)

(c) (i) Find $P(3 < X \leq 6)$ when $X \sim B(7, 0.5)$. (2 marks)

(ii) Find $P(X > 3)$ when $X \sim Po(7.05)$. (3 marks)

~ The End ~

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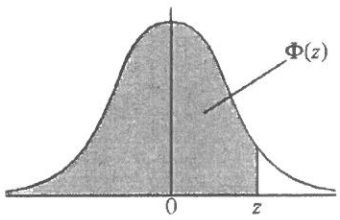
THE NORMAL DISTRIBUTION FUNCTION

If Z has a normal distribution with mean 0 and variance 1 then, for each value of z, the table gives the value of $\Phi(z)$, where

$$\Phi(z) = \mathrm{P}(Z \le z).$$

For negative values of z use $\Phi(-z) = 1 - \Phi(z)$.



z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
											ADD								
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359	4	8	12	16	20	24	28	32	36
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753	4	8	12	16	20	24	28	32	36
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141	4	8	12	15	19	23	27	31	35
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517	4	7	11	15	19	22	26	30	34
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879	4	7	11	14	18	22	25	29	32
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224	3	7	10	14	17	20	24	27	31
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549	3	7	10	13	16	19	23	26	29
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852	3	6	9	12	15	18	21	24	27
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133	3	5	8	11	14	16	19	22	25
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389	3	5	8	10	13	15	18	20	23
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621	2	5	7	9	12	14	16	19	21
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830	2	4	6	8	10	12	14	16	18
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015	2	4	6	7	9	11	13	15	17
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177	2	3	5	6	8	10	11	13	14
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319	1	3	4	6	7	8	10	11	13
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441	1	2	4	5	6	7	8	10	11
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545	1	2	3	4	5	6	7	8	9
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633	1	2	3	4	4	5	6	7	8
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706	1	1	2	3	4	4	5	6	6
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767	1	1	2	2	3	4	4	5	5
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817	0	1	1	2	2	3	3	4	4
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857	0	1	1	2	2	2	3	3	4
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890	0	1	1	1	2	2	2	3	3
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916	0	1	1	1	1	2	2	2	2
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936	0	0	1	1	1	1	1	2	2
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952	0	0	0	1	1	1	1	1	1
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964	0	0	0	0	1	1	1	1	1
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974	0	0	0	0	0	1	1	1	1
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981	0	0	0	0	0	0	0	1	1
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986	0	0	0	0	0	0	0	0	0

Critical values for the normal distribution

If Z has a normal distribution with mean 0 and variance 1 then, for each value of p, the table gives the value of z such that

$$\mathrm{P}(Z \le z) = p.$$

p	0.75	0.90	0.95	0.975	0.99	0.995	0.9975	0.999	0.9995
z	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291