FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Foundation in Science (CFSI)
Course	:	**STA1202: Statistics**
Date of Examination	:	5 August 2020 (Wednesday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.
All questions carry equal marks.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Formula Booklet 1, Graph Paper

Examiner(s)	:	**Ms. Ng Ci Xiang**
Chief Moderator	:	Ms. Teng Mei Tuan

This paper consists of 7 printed pages, including the cover page.

FOUNDATION IN SCIENCE (CFSI)
STA1202: STATISTICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instruction: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Question 1

(a) The table summarises the times that 112 people took to travel to work on a particular day.

Time to travel to work (t minutes)	$0 < t \leqslant 10$	$10 < t \leqslant 15$	$15 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 40$	$40 < t \leqslant 60$
Frequency	19	12	28	22	18	13

(i) On graph paper, draw a histogram to represent the data. (4 marks)

(ii) Estimate the number of people that took between 30 to 45 minutes to travel to work. (3 marks)

(b) A fair tetrahedral die has four triangular faces, numbered 1, 2, 3 and 4. The score when this die is thrown is the number on the face that the die lands on. This die is thrown three times. The random variable X is the sum of the three scores.

(i) Show that $P(X = 9) = \frac{5}{32}$. (3 marks)

(ii) Copy and complete the probability distribution table for X. You need to show all the workings for getting the answers. (5 marks)

x	3	4	5	6	7	8	9	10	11	12
$P(X = x)$	$\frac{1}{64}$	$\frac{3}{64}$			$\frac{12}{64}$					

(iii) Calculate the variance of X. (4 marks)

(c) In a recent survey, 640 people were asked about the length of time each week that they spent watching television. The median time was found to be 20 hours, and the lower and upper quartiles were 15 hours and 35 hours respectively. The least amount of time that anyone spent was 3 hours, and the greatest amount was 60 hours.

(i) On graph paper, show these results using a fully labelled cumulative frequency graph. (4 marks)

(ii) Use your graph to estimate how many people watched more than 50 hours of television each week. (2 marks)

Question 2

(a) 120 people were asked to read an article in a newspaper. The times taken, to the nearest second, by the people to read the article are summarized in the following table.

Time (seconds)	1 – 25	26 – 35	36 – 45	46 – 55	56 – 90
Number of people	4	24	38	34	20

Calculate the mean and standard deviation of the reading times. (5 marks)

(b) A bag contains 3 red balls and 7 blue balls. Whenever a red ball is drawn, it will be replaced in the bag and whenever a blue ball is drawn, it is not replaced. 3 balls are drawn randomly one after another.

(i) Construct a probability tree diagram showing this information. (2 marks)

Find the probability that

(ii) all the balls are blue, (1 mark)

(iii) at least one of the balls is blue, (2 marks)

(iv) exactly two of the balls are blue. (2 marks)

Given that exactly 2 of the 3 balls drawn are blue, find

(v) the probability that the first ball drawn is blue. (3 marks)

(c) People arrive at a checkout in a store at random, and at a constant mean rate of 0.7 per minute. Find the probability that

(i) exactly 3 people arrive at the checkout during a 5-minute period, (2 marks)

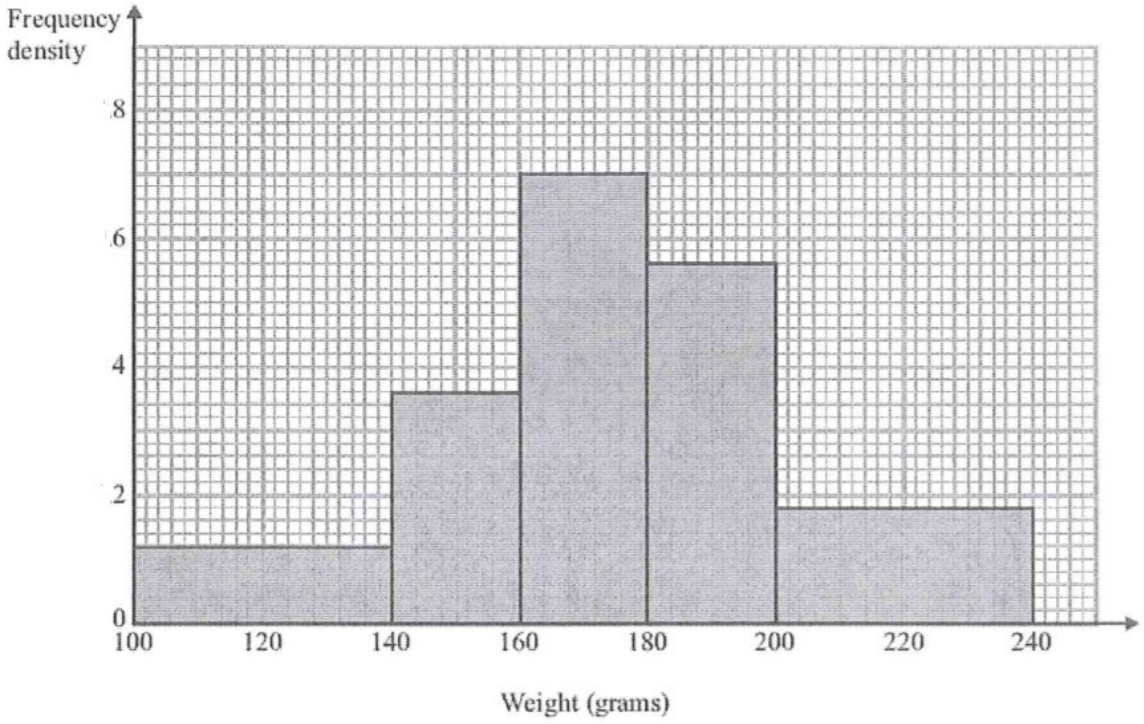
(ii) at least 4 people arrive at the checkout during a 0.25-hour period. (4 marks)

People arrive independently at another checkout in the store at random, and at a constant mean rate of 0.5 per minute.

(iii) Find the probability that a total of more than 3 people arrive at this pair of checkouts during a 2-minute period. (4 marks)

Question 3

(a) The histogram shows some information about the weights of a sample of apples.



(i) Copy and complete the table below. (4 marks)

Class boundaries	width	Frequency density	Frequency	Mid-point
100 – 140 140 – 160 : :				

(ii) Find the percentage of apples in the sample with a weight between 140 grams and 200 grams. (2 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)

(b) Playground equipment consists of swings (S), roundabouts (R), climbing frames (C) and play-houses (P). The numbers of pieces of equipment in each of 3 playgrounds are as follows.

Playground X	Playground Y	Playground Z
$3S,\ 2R,\ 4P$	$6S,\ 3R,\ 1C,\ 2P$	$8S,\ 3R,\ 4C,\ 1P$

Each day Nur takes her child to one of the playgrounds. The probability that she chooses playground X is $\frac{1}{4}$. The probability that she chooses playground Y is $\frac{1}{4}$. The probability that she chooses playground Z is $\frac{1}{2}$. When she arrives at the playground, she chooses one piece of equipment at random.

(i) Find the probability that Nur went to playground X and chose roundabouts. (2 marks)

(ii) Find the probability that Nur chooses a play-house. (4 marks)

(iii) Given that Nur chooses a climbing frame, find the probability that she chose playground Y. (4 marks)

(c) The distance that car tyres of a certain brand can travel is normally distributed. A survey of a large number of these tyres found that the probability of this distance being more than 36 800 km is 0.0082 and the probability of this distance being more than 31 000 km is 0.6915. Find the mean and standard deviation of the distribution. (5 marks)

Question 4

(a) Events A and B are such that $P(B)=\frac{7}{18}$, $P(A\mid B)=\frac{4}{7}$ and $P(A'\cap B')=\frac{1}{3}$. Find

(i) $P(A\cap B)$ (1 mark)

(ii) $P(A)$ (4 marks)

(b) On average 79.4% of a certain company's pea seeds germinate. The pea seeds are sold in trays of 24.

(i) State, in context, two assumptions needed for the number of pea seeds that germinated in a tray to be well modelled by a binomial distribution. (2 marks)

Assume now that the number of pea seeds that germinated in a tray has a binomial distribution.

(ii) Find the probability that 15 or 16 pea seeds germinate in a tray. (3 marks)

The trays are packed into cartons. Each carton contains 8 trays.

(iii) Find the probability that each tray in one randomly selected carton contains at least twenty pea seeds that germinated. (5 marks)

(c) In a high school, the times taken, in minutes for boys to complete their 2.4 km test run have normal distributions with mean 11.51 and standard deviation 0.72.

(i) Find the probability that a randomly chosen boy takes less than 10 minutes to complete the run. (3 marks)

A boy who takes less than 10 minutes to complete the run is considered a fast runner.

(ii) A boy is chosen at random. Given that he is a fast runner, find the probability that he takes less than 9.50 minutes to complete the run. (4 marks)

(iii) Less than 40% of the boys take more than t minutes to complete the run. Find the set of values of t. (3 marks)

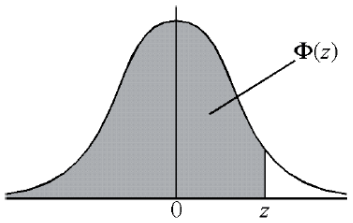
~ The End ~

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