MODULE 2 STATISTICS

QUESTION 1

The results of a survey show that 80% of Form V students do some sort of physical exercise at least 4 times a week.

1.1 A random sample of 6 students is selected. Find the probability that at least 2 students do some sort of physical exercise at least 4 times a week. (6)

1.2 A second sample of 60 students is selected. The random variable X denotes the number of students who do some sort of physical exercise at least 4 times a week.

(a) Using a suitable approximation, find the probability that at least 45 students of the sample do some sort of physical exercise at least 4 times a week. (8)

(b) Justify the use of the approximation in (a) mathematically. (2)

(c) Why does this justification in (b) need to be provided to ensure that the approximation in (a) is suitable? (2)

[18]

QUESTION 2

The alkalinity, in $mg/litre$, of water in the upper and lower reaches of rivers in a particular region is known to be normally distributed with a standard deviation of $10mg/l$. Alkalinity readings in the lower reaches of rivers in the same region are also known to be normally distributed, but with a standard deviation of $25mg/l$. Ten alkalinity readings made in the upper reaches of a river in the region and fifteen in the lower reaches of the same river gave the following results:

Upper reaches	*91*	*75*	*91*	*88*	*94*	*63*	*86*	*77*	*71*	*69*				
Lower reaches	86	95	135	121	68	64	113	108	79	62	143	108	121	85
	97													

Investigate, at the 1% level of significance, the claim that the true mean alkalinity of water in the lower reaches of this river is greater than that in the upper reaches.

[12]

QUESTION 3

3.1 It is believed that 15% of the population in South Africa is immune to Covid -19. If a random sample of South Africans is taken, how large would the sample have to be, to be 98% sure of obtaining an estimate within 5%? (8)

3.2 A survey is conducted to determine the mean mass of 64 women between the ages of 30 and 40. The results produced a confidence interval of $(59kg; 63kg)$ with a standard deviation of $9kg$.

(a) What is the sample mean? (2)

(b) Determine the level of confidence, to the nearest percentage, that the interval contains the true mean. (8)

[18]

QUESTION 4

The probability distribution of outcomes when the St Mary's first hockey team plays the Eunice first hockey team three times is shown in the table. X represents the number of games that the St Mary's first team wins.

x	0	1	2	3
$P(X = x)$	0,12	0,22	p	q

4.1 Given that the expected value of X is $1{,}9$, find the values of p and q. (8)

4.2 Using the probabilities above and showing all working, find the standard deviation of X. (6)

[14]

QUESTION 5

The Two Oceans race takes place in Cape Town annually. This year the race took place virtually and the times taken for the competitors to complete the race were normally distributed. The mean time for finishing the 20 km race was 150 min.

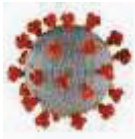
5.1 If 80% of the competitors took less than 3 hours to complete the race, determine the value of σ to the nearest minute. (6)

5.2 Determine the probability that a competitor chosen at random finished the race in less than 120 min. (6)

[12]

QUESTION 6

6.1 The Milpark hospital tests all incoming patients for Covid-19. It is found that:



- 97% of patients with the disease are declared positive.
- 5% of patients without the disease are declared positive.

Over the last year the hospital has found that 37% of incoming patients have Covid-19.

(a) Calculate the probability that an incoming patient is declared positive. (6)

(b) Determine the probability that an incoming patient is actually suffering from Covid-19 given that the patient is declared positive. (4)

6.2 Eleven **different** tablets are to be displayed in a line in a shop.

(a) Find the number of different ways the tablets can be arranged. (2)

(b) Of these tablets, 6 are iPads and 5 are Samsung tablets. Find the number of different ways the tablets can be arranged so that no two Samsung tablets are next to each other. (4)

(c) Consumers need to vote for the best tablet. There are three categories: **Best Graphics, Best Processor and Most User friendly.**

(i) Find the number of different ways in which these three prizes can be awarded if there are no restrictions. (4)

(ii) Determine the probability that at most 2 Samsung tablets will win any of the prizes if a tablet can only win one of the three prizes. (6)

[26]

Total for Module 2: 100 marks