1. The following table shows the spending of a random sample of 30 visitors in the Global Vision Hotel during Christmas Holidays in 2020.

Spending ($)	Number of Visitors
3000 – 4499	2
4500 – 5999	9
6000 – 7499	12
7500 – 8999	5
9000 – 10499	2

   (a) Calculate the mean, median and standard deviation. [6 marks]

   (b) Calculate the coefficient of skewness using results in (a) and interpret your result briefly. [2 marks]

   (c) Spending of a random sample of visitors in the International Sightseeing Hotel has a mean of $6280 and a standard deviation of $2880. Discuss which hotel has a larger variation in visitors' spending. [4 marks]

   (d) Develop a 99% confidence interval for the population mean of spending in the Global Vision Hotel during Christmas Holidays. [4 marks]

   (e) Suppose the Global Vision Hotel wants to conduct a similar survey next year. What is the recommended sample size if the desired margin of error is no more $200 with 98% confidence? [4 marks]

2. (a) If 4 boys and 5 girls randomly form a queue, find the probability that in the queue

      (i) all boys stand next to each other; [3 marks]

      (ii) all boys and girls stand alternately; [3 marks]

      (iii) no boys stand next to each other. [3 marks]

   (b) Suppose that we have 3 coins identical in form except that both sides of the first coin are heads, both sides of the second coin are tails, and the third coin is a fair coin, The 3 coins are mixed up in a hat, and 1 coin is randomly selected and put down on the ground. If the upper side of the chosen coin is head, what is the probability that the other side is tail? [5 marks]

   (c) Consider an urn containing 6 balls of which 3 are black 2 are white and 1 is red. A sample of size 3 is to be drawn (without replacement). Let A be the event that there is at least one black ball and B be the event that 3 balls are of different colors. Are the events A and B independent or dependent? Why? [6 marks]

3. (a) A manufacturer of window frames knows from long experience that 5% of the production will have some type of minor defect that will require an adjustment. A random sample of 20 window frames is chosen from this manufacturer.

   (i) How many of these window frames would you expect to have a minor defect that will require an adjustment? and what is the standard deviation? [2 marks]

   (ii) What is the probability that there is more than two window frames that will need adjustment? [3 marks]

   (b) A recent crime report indicates that 0.7 telephone scam calls occur each day. Assume that the distribution of telephone scam calls per day can be approximated by the Poisson probability distribution.

   (i) Calculate the probability exactly four telephone scam calls occur in a day. [2 marks]

   (ii) What is the probability there is at least three telephone scam call in a week? [4 marks]

   (iii) What is the probability that at least 75 out of 80 randomly selected weeks have at least three telephone scam calls each? [4 marks]

   (c) The life of certain type of Portable Chargers is normally distributed with a mean of 7.2 years and a standard deviation of 1.9 years.

   (i) What percentage of these Portable Chargers last between 2.4 and 4.8 years? [2 marks]

   (ii) Suppose the manufacturer wants to establish a warranty so that only about lowest 15% of these Portable Chargers will need to be repaired under the warranty. What is the maximum number of years a Portable Charger will last to be able to receive repairs for it, under the warranty. [3 marks]

4. (a) Suppose that a student measuring the boiling temperature of a certain liquid observes the readings (in degrees Celsius) 82.5, 81.7, 83.1, 80.9, 80.5, and 82.2 on 6 different samples of the liquid. What is the confidence interval for the population mean at a 95% confidence level? State the assumption, if any, that you have used in your calculation. [8 marks]

(b) In a survey with 240 primary school students , 70% of the students prefer reading e-book than ordinary books. While in a survey with 200 university students, 75% of the students prefer reading e-book than ordinary books. Construct a 95% confidence interval to estimate the difference of the two population proportions. [6 marks]

(c) Suppose we are interested in a population of a large number of industrial units of the same size, all of which are experiencing excessive labour turnover problems. A sample of 5 of these industrial units is taken at random, which give a mean of annual turnover as 300 employees, with a standard deviation of 75 employees. Construct a 95% confidence interval to estimate the mean of annual turnover of all industrial units. State the assumption, if any, that you have used in your calculation. [6 marks]

5. (a) To manage the COVID-19 Vaccine Booster Shots arrangement, two hospital emergency rooms use different procedures for triage of their patients. The 40 randomly selected subjects from The Eastern hospital produce a mean of 18.30 minutes. The 50 randomly selected patients from The Western hospital produce a mean of 25.31 minutes. Assume the population standard deviation for The Eastern hospital is 2.10 minutes and The Western hospital is 2.92 minutes. At 2% level of significance, test the claim that the mean waiting time of patients is the same for both hospitals. [5 marks]

(b) Out of the 265 female citizen, 106 of them are using 'Leave Home Safe' app when they are dinning in restaurants. Out of the 285 male citizen, only 57 of them are using 'Leave Home Safe' app when they are dinning in restaurants. At 5% significance level, can we conclude that the proportion of female citizen is more than 5% higher than proportion of male citizen using 'Leave Home Safe' app when they are dinning in restaurants? [5 marks]

(c) A class teacher is interested in whether absence occur during the week with equal frequency. The teacher took a random sample of 100 absences and created the following table:

Day	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
Number of Absences	28	20	12	18	22

At the 2.5% level of significance, determine whether there is a relationship between the day and the number of absences. [5 marks]

(d) A survey was made to investigate the relationship between where the district students resided in Hong Kong and the number of student who attend the lecture online. A random sample of 142 students shows the following results:

	Hong Kong Island	Kowloon Peninsula	New Territories	Lantau Island
Number of students who attended lectures online	10	9	15	9
Number of students who attended lectures face-to-face	26	28	18	27

At significance level of 1%, determine whether there is relationship between where the district students resided in Hong Kong and the number of students who attend the lecture online. [5 marks]

6. (a) Suppose that we want to investigate the relationship between the monthly e-commerce sales (Y) and the online advertising costs (X). A random sample of size 8 is obtained as follows:

Online Store	Monthly E-commerce Sales (in \$1000 s)	Online Advertising Costs (in \$1000 s)
1	368	1.7
2	340	1.5
3	665	2.8
4	556	2.2
5	376	1.3
6	654	3
7	331	1.3
8	472	2

Given that:

$$\sum x = 15.8,\ \sum y = 3762,\ \sum x^2 = 34.2,\ \sum y^2 = 1903822,\ \sum xy = 8045.9$$

(i) Find the least squares linear regression equation for predicting the sales from the advertising costs. [4 marks]

(ii) Calculate the coefficient of determination. [2 marks]

(iii) Interpret the coefficient estimate of the independent variable. [2 marks]

(iv) Calculate the Spearman's rank correlation coefficient for the above data and interpret the result. [4 marks]

(b) An analyst wants to know how the movement of the market affects the stock price of an international oil and gas corporation. He believes that the price of oil, interest rates, and the price movement of oil futures can affect the stock price of the company. The data of 12 randomly selected months are collected and input into a statistical software for analysis. He builds a multiple regression model and finds that the coefficient of determination is 86.25%. Preform an F-test to test whether the regression model is significant at 5% level of significance. [8 marks]