Practical 3

Question 1

(a) If everyone had only two names, a first name and a family name, how many pairs of initials would be possible?

(b) A football league of MSc students at the LSHTM contains 8 teams. How many matches need to be played in order that each team plays once against every other team?

(c) A MSc group contains 9 males and 11 females. In how many ways can a committee of two males and two females be formed from the class?

(d) A group of 6 male doctors and 6 female doctors is randomly divided into two groups of size 6 each. What is the probability that both groups will have the same number of men?

Question 2

Last week's newspaper reported that approximately 20% of the children in the United States are obese. Random samples are taken from the population.

(a) In a random sample of 1, what is the probability that the child is obese?

(b) In a random sample of 2, what is the probability that both are obese?

(c) In a random sample of 5, what is the probability that 4 or 5 are obese?

(d) In a random sample of 10, what is the probability that at least one is obese?

Question 3

A study of miscarriage surveyed a group of 70 women, each of whom had been pregnant four times. From the 280 pregnancies included in the study, the total number of miscarriages experienced was 81.

(a) What proportion of the total number of pregnancies resulted in miscarriage?

(b) Suggest a possible distribution that we might use to model these data.

(c) Calculate the expected probability distribution of the number of miscarriages per woman, under your assumed distribution.

(d) Using the expected probability distribution, obtain the expected frequencies among a sample of 70 women (i.e. out of 70 women, how many would we expect to have 0, 1, ... miscarriages?).

The data in the table show the observed distribution of women according to the number of miscarriages they had experienced.

Number of miscarriages	Number of women
0	24
1	28
2	7
3	5
4	6

Source: Doyle P. (1974) M.Sc. dissertation, LSHTM

(e) Do the observed and expected frequencies appear to agree? Suggest reasons for any apparent differences.

Question 4

According to the National Office of Vital Statistics of the U.S. Department of Health, Education and Welfare, the average number of accidental drownings per year in the United States is 3.0 per 100,000 persons in the population.

(a) What is the expected number of accidental drownings per year in a city of 200,000 people?

(b) Suggest a possible distribution that we might use to model these data.

Find the probability that in a city of 200,000 people there will be:

(c) 0 accidental drownings per year

(d) between 1 and 2 accidental drownings per year (inclusive)

(e) fewer than 3 accidental drownings per year

Optional: Question 5

Derive the expectation and variance of a Poisson random variable X with parameter μ.