(Time constraints may require continuation in Week 3.)

Question 1

A fair coin is tossed three times. Write out the sample space S and the sample points of the following events:

(a) the event that the first toss is heads,

(b) the event that the second toss is heads,

(c) exactly two heads in a row.

Question 2

Consider couplse that have two children. Treating the gender of the children as an **ordered pair** outcome of a random experiment, the sample space is

$$S = \{(b,b), (b,g), (g,b), (g,g)\}.$$

Let us assume that each sample point is **equiprobable**, with probability 0.25 for each sample point. Find the probability p that both children are girls if it is known that:

(a) at least one of the children is a girl,

(b) the older child is a girl.

Question 3

Compute the probability p of each event:

(a) An even number appears in the toss of a fair die,

(b) One or more tails appear in the toss of three fair coins,

(c) A blue marble appears in a random drawing of one marble from a box containing four white, three blue, and five red marbles.

Question 4

Suppose a student is selected at random from 100 students where 30 are taking mathematics, 20 are taking computer science, and 10 are taking mathematics and computer science. Find the probability p that the student is taking mathematics or computer science.

Question 5

A lot contains 13 items of which 4 are defective. Three items are drawn at random from the lot one after the other. Find the probability p that all three are non-defective.

Question 6

The probability that A hits a target is 1/3 and the probability that B hits a target is 1/5. They both fire at the target. Find the probability that:

(a) A does not hit the target,

(b) both hit the target,

(c) only one of them hits the target,

(d) at least one hits the targetl

(e) neither hits the target.

Question 7

On completion of a programming project, four programmers from a team submit a collection of subroutines to an acceptance group. The following table shows the percentage of subroutines each programmer submitted and the probability that a subroutine submitted by each programmer will pass the certification test based on historical data.

Programmer	A	B	C	D
Proportion of subroutines submitted	0.1	0.2	0.3	0.4
Probability of acceptance	0.55	0.6	0.95	0.75

(a) What is the proportion of subroutines that pass the acceptance test?

(b) After the acceptance tests are completed, one of the subroutines is selected at random and found to have passed the test. What is the probability that it was written by Programmer A?

Question 8

Two manufacturing plants produce similar parts. Plant A produces 1000 parts, 100 of which are defective. Plant B produces 2000 parts, 170 of which are defective.

a) Present this information using a contingency table

b) A part is selected at random and found to be defective. What is the probability that it came from plant A ?

Question 9

A machine is composed of 2 components A and B, which function independently of one another. The machine works only if both components are working. The probability that component A works is 0.98 and the probability that component B works is 0.95.

a) What is the probability that the machine works,

b) What is the probability that both components have failed.

Question 10

A doctor treating a patient issues a prescription for antibiotics and provides for two repeat prescriptions. The probability that the infection will be cleared by the first prescription is p1 =0.6.

The probability that successive treatments are successful, given that previous prescriptions were not successful are $p_2 = 0.5$, $p_3 = 0.4$. Calculate the probability that

(a.) the patient is still infected after the third prescription,

(b.) the patient is cured by the second prescription,

(c.) the patient does not require a third prescription,

(d.) the patient is cured by the second prescription, given that the patient is eventually cured.

Question 11

The following data give the marks of 10 students in a test (out of 20 marks). Calculate

(a.) the median

(b.) the mean

(c.) the range

(d.) the standard deviation

(e.) The Inter-Quartile Range

$$12, 17, 7, 11, 18, 6, 14, 15, 11, 9.$$