Expected Values

1. A €5, €10, €20, €50, €100 and €500 note are placed into a hat. You get to pick one note out at random as a prize. What is the expected value of your prize?

2. You play a game which involves rolling two dice and adding the scores. If the scores total to 4 or lower, or, if the scores total to 10 or higher, you will win €15. If the scores total to any other value you win €7.50. Is €10 a fair price to play the game?

3. In basketball, scoring a basket in play is worth either two points or three points, depending on how far from the basket the shot was taken. A certain basketball team shoots two point shots with 47% accuracy and they shoot three point shots with 36% accuracy.
   i. Is the team better off shooting more two point or three point shots?
   ii. A free throw is worth one point. The team shoots free throws with 80% accuracy. In a certain game, the team shoots 44 two point shots, 23 three point shots, and 20 free throws. What is their expected score in the game?

4. A pair of fair six-sided dice is rolled and the total on the two dice is noted.
   i. Copy and complete the following probability distribution table:

Sum	2	3	4	5	6	7	8	9	10	11	12
Probability				$\frac{4}{36}$					$\frac{3}{36}$		

   ii. Calculate the expected value.

5. The members of a local minor football team were asked their ages. The probability distribution of their ages is outlined in the table below:

Age	15	16	17	18
P(X=Age)	x	0.15	0.3	y

   Given that the expected age of a randomly selected member of the team is 17.25, find the value of x and y.

6. Every student in a class of 35 were asked how many people were in their family (including parents). The results are displayed in the table below.

Number of family members	2	3	4	5	6	7
Frequency	1	4	9	12	6	3

   i. Create a probability distribution table for the variable X, where X is the number of people in the family of a randomly selected student.
   ii. If a student is selected at random, what is the expected number of people in his/her family?

7. The table below gives motor insurance information for fully licensed, 17-20 year old drivers in Ireland in 2007. All drivers who had their own insurance policy are included.

	Number of drivers	Number of claims	Average cost per claim
Male	9634	977	€6108
Female	6743	581	€6051

Questions (i) to (v) refer to drivers in the table above only.

i. What is the probability that a randomly selected male driver made a claim during the year? Give your answer correct to three decimal places

ii. What is the probability that a randomly selected female driver made a claim during the year? Give your answer correct to three decimal places.

iii. What is the expected value of the cost of claims on a male driver's policy?

iv. What is the expected value of the cost of claims on a female driver's policy?

v. The male drivers were paying an average of €1688 for insurance in 2007, and the female drivers were paying an average of €1024. Calculate the average surplus for each group, and comment your answer.(Note: the surplus is the amount paid for the policy minus the expected cost of claims)

vi. A 40-year-old female driver with a full license has a probability of 0.07 of making a claim during the year. The average cost of such claims is €3900. How much should a company charge such drivers for insurance in order to show a surplus of €175 per policy?

(Leaving Cert. Project Maths Paper 2, 2010)