Tutorial Sheet 3

Please prioritise the questions marked with an asterisk (*) and the multiple-choice questions. If time permits, feel free to attempt the remaining questions. I will be reviewing all questions during the tutorial.

Probability Mass Distributions

Question 1 *

1. The probability mass function of a discrete random variable X is given in the following table:

i	1	2	3	4	5
x	0	1	2	3	4
p(x)	0.1	0.2	0.4	0.2	0.1

   i. Find the E[X] and Var[X].

   ii. Sketch the probability mass function.

   iii. Give the cumulative probability mass function of a discrete random variable X.

   iv. Sketch the cumulative probability mass function

Question 2

2. The probability mass function of a discrete random variable X is given in the following table:

i	0	1	2	3	4
x	-2	-1	0	1	2
p(x)	0.1	0.3	0.3	p3	0.1

   i. Show that p3 = 0.2

   ii. Calculate the E[X] and Var[X].

   iii. Sketch the distribution.

Question 3 *

20% of the Irish population watched Ireland beat France in the Rugby World Cup 2019. A representative from TV3 marketing was sent to Grafton Street to ask passersby their opinion of the match coverage. Let X denote the number of people need to be asked til the marketer successfully finds someone who watched the game.

   i. Give the Geometric probability mass function for X.

   ii. Find the probability that the marketer had to ask exactly 2 people.

   iii. What is the E[X] and Var [X] of the distribution.

Very Optional Question 4

4. The probability mass function of a Bernoulli random variable X is given in the following table:

x	0	1
p(x)	q	p

Find the mean E[X] and variance Var[X].

Multiple-Choice Questions

MCQ Question 5

Which of the following is true about a probability mass function (PMF) of a discrete random variable?

A) The PMF can take any value greater than or equal to 0.
B) The sum of all values of a PMF is 1.
C) The PMF can take negative values.
D) The PMF is defined for continuous random variables.

MCQ Question 6

The probability mass function of a discrete random variable X is given in the following table:

i	1	2	3	4
x	-4	-2	2	6
p(x)	0.1	0.3	0.4	0.2

What is the probability that X takes a value greater than -2?

A) 0.1
B) 0.2
C) 0.6
D) 0.4
E) 0.7

MCQ Question 7

Which of the following best describes the geometric distribution?

A) It models the number of successes before the first failure in a series of independent Bernoulli trials.
B) It models the number of trials until the first success in a series of independent Bernoulli trials.
C) It models the number of failures before the first success in a series of dependent Bernoulli trials.
D) It models the number of trials until the first success in a series of dependent Bernoulli trials.

MCQ Question 8

Spot three reasons why the following table cannot be a probability mass function of a discrete random variable X:

i	1	2	3	4

x	4	-2	2	6
p(x)	0.1	-0.3	0.4	0.2

MCQ Question 9

What is the variance of a Bernoulli random variable with success probability $p = 0.6$?

A) 0.24

B) 0.36

C) 0.4

D) 0.6

MCQ Question 10

Which statement best describes a cumulative distribution function (CDF)?

A) It gives the probability of a specific value.

B) It gives the probability that a variable is greater than a value.

C) It gives the probability that a variable is less than or equal to a value.

D) It gives the expected value of a distribution.

Question 11

Write your own question for a geometric distribution.