Discrete Random Variables – 2021/20 GCE Statistics Further Math A Y542

1. Nov/2021/Paper_Y542/01/No.2

A discrete random variable D has the following probability distribution, where a is a constant.

d	0	2	4	6
$P(D=d)$	a	0.1	0.3	0.2

Determine the value of Var$(3D+4)$. [7]

2. Nov/2021/Paper_Y542/01/No.3

In a large collection of coloured marbles of identical size, the proportion of green marbles is p. One marble is chosen randomly, its colour is noted, and it is then replaced. This process is repeated until a green marble is chosen.

The first green marble chosen is the Xth marble chosen.

(a) You are given that $p = 0.3$.

   (i) Find $P(5 \leqslant X \leqslant 10)$. [2]

   (ii) Determine the smallest value of n for which $P(X = n) < 0.1$. [2]

(b) You are given instead that Var$(X) = 42$.

   Determine the value of $E(X)$. [5]

3. Nov/2021/Paper_Y542/01/No.8

The continuous random variable Y has a uniform distribution on $[0, 2]$.

(a) It is given that $E[a\cos(aY)] = 0.3$, where a is a constant between 0 and 1, and aY is measured in radians.

   Determine the value of the constant a. [5]

(b) Determine the 60th percentile of Y^2. [6]

4. Nov/2020/Paper_Y542/01/No.6

The numbers of CD players sold in a shop on three consecutive weekends were 7, 6 and 2. It may be assumed that sales of CD players occur randomly and that nobody buys more than one CD player at a time. The number of CD players sold on a randomly chosen weekend is denoted by X.

(a) How appropriate is the Poisson distribution as a model for X? [2]

Now assume that a Poisson distribution with mean 5 is an appropriate model for X.

(b) Find

    (i) $P(X = 6)$, [2]

    (ii) $P(X \geqslant 8)$. [2]

The number of integrated sound systems sold in a weekend at the same shop can be assumed to have the distribution Po(7.2).

(c) Find the probability that on a randomly chosen weekend the total number of CD players and integrated sound systems sold is between 10 and 15 inclusive. [3]

(d) State an assumption needed for your answer to part **(c)** to be valid. [1]

(e) Give a reason why the assumption in part **(d)** may not be valid in practice. [1]