Section Check In – 2.04 Statistical Distributions

Questions

1. The probability distribution of a discrete random variable X is given by
   $P(X = x) = \frac{kx}{4}$ for $x = 1, 2, 3, 4$
   Find the value of k and tabulate the probability distribution of X.

2. If $X \sim B(14, 0.3)$ find $P(X = 2)$.

3. An optician has ten appointments a day. The number of these appointments of which someone is classed as being short-sighted is denoted by S. The variable S is modelled by the distribution $S \sim B(10, 0.35)$. Show that according to this model, the optician is more likely to see four people who are short-sighted in one day than two people.

4. John organises a running race around a park. He assumes that the probability of each person entering the race being a male is 0.7.

   (i) Calculate the probability that the first 20 people to enter are all males.

   (ii) Calculate the probability that the first 6 people to enter the race will comprise three males and three females.

Worked solutions

1. $\frac{k}{4}+\frac{2k}{4}+\frac{3k}{4}+\frac{4k}{4}=1\Rightarrow\frac{10k}{4}=1\Rightarrow k=0.4$

X	1	2	3	4
$P(X=x)$	$\frac{1}{10}$	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{4}{10}$

2. $P(X=2)=\binom{14}{2}\times0.3^2\times0.7^{12}=0.113\ (3\text{sf})$ or by using calculator probability functions (**BC**).

3. $P(X=4)=\binom{10}{4}\times0.35^4\times0.65^6=0.238\ (3\text{sf})$

   $P(X=2)=\binom{10}{2}\times0.35^2\times0.65^8=0.176\ (3\text{sf})$

4. (i) $0.7^{20}=0.000798\ (3\text{sf})$

   (ii) Let X be the number of males in the first 6 to enter the race.

   $X\sim B(6,0.7)\Rightarrow P(X=3)=\binom{6}{3}\times0.7^3\times0.3^3=0.18522$

   If 3 are male then the other 3 are female.