Statistics 4 Tutorial: Special DRV – Binomial Distribution

Basic Mastery Questions

	With reference to the Learning Target Checklist, this question demonstrates Check point No.

1. On any given day, about 45% of the stocks on the Singapore Stock Exchange increase in value. Suppose four stocks are chosen. Let the discrete random variable X denote the number of stocks that increase in value.

(a) Does X follow a binomial distribution? State any assumptions that you need to make.	6
(b) Suppose X follows a binomial distribution. Find the probability that: (i) exactly three of the stocks increase in value?	5a
(ii) at least three of the four stocks increase in value?	5b

2. The random variable X has a binomial distribution with mean 8 and variance $\dfrac{8}{3}$. Calculate $P(X \geq 10)$, giving 3 decimal places in your answer.

5b

Solutions

1(a) X = Number of stocks (out of 4) that increase in value

It might <u>not</u> be <u>appropriate</u> to assume X follows binomial distribution here because the increase in value among stocks is usually not independent, i.e. when one stock increases in value, the other stocks might be affected at the same time.

If we want X to follow binomial distribution, we need to assume that

- **The event** that a stock increases in value is **independent** of the **event** that another stock increasing in value.
- The **probability** that a randomly chosen stock increases in value is **constant**, at 0.45

1(b) Suppose X follows a binomial distribution, then its distribution will be:

$$X \sim B(4, 0.45)$$

(i) $P(X = 3) = 0.200$ (to 3sf)

(ii) $P(X \geq 3) = 1 - P(X \leq 2) = 1 - 0.759 = 0.241$ (to 3sf)

2. The random variable X has a binomial distribution with mean 8 and variance $\dfrac{8}{3}$. Calculate $P(X \geq 10)$, giving 3 decimal places in your answer.

Solution:

$X \sim B(n, p)$ then

$np = 8 \ldots\ldots\ldots\ldots(1)$

$np(1 - p) = \dfrac{8}{3}\ldots\ldots(2)$

Solving, $p = \dfrac{2}{3}, n = 12$.

$P(X \geq 10) = 1 - P(X \leq 9) = 0.181$