

1. Sam is playing a computer game.

When Sam earns a reward in the game, she randomly receives either a Silver reward or a Gold reward.

Each time that Sam earns a reward, the probability of receiving a Gold reward is 0.4

One day Sam plays the computer game and earns 11 rewards.

- (a) Find the probability that she receives
- (b)(ii) $G \sim N(120, (\sqrt{72})^2)$
- (i) exactly 2 Gold rewards, $P(\text{Binomial } G \geq 135) = P(\text{Normal } G \geq 134.5)$ (1 mark)
- (ii) at least 5 Gold rewards. $\begin{matrix} \text{because of} \\ \text{continuity} \\ \text{correction} \end{matrix} \quad \text{for } P(\text{Normal } G \geq 134.5) \quad (2)$
- $\left(\begin{matrix} \text{same as} \\ \text{for continuous dist.} \end{matrix} \right) \quad (2)$

In the next month Sam earns 300 rewards.

$\left. \begin{matrix} \text{fx-991EX: MENU 7-Dist/Normal CD} \\ \text{OR fx-CG50: DIST/NORM/NCd} \end{matrix} \right\} = 0.04374 \dots = 0.0437 \text{ 3sf} \quad (1 \text{ mark})$

She decides to use a Normal distribution to estimate the probability that she will receive at least 135 Gold rewards.

- (b) (i) Find the mean and variance of this Normal distribution. (2)
- (ii) Estimate the probability that Sam will receive at least 135 Gold rewards. (2)

(a) Let G be the no. of Gold rewards
 $G \sim B(11, 0.4)$ (1 mark)

(a)(i) $P(G=2) = {}^{11}C_2 0.4^2 (1-0.4)^{11-2}$
 $= {}^{11}C_2 0.4^2 0.6^9 = 0.08868 \dots = 0.0887 \text{ 3sf}$
 OR fx-991EX: MENU 7-Distribution/Binomial PD/Variable (1 mark)
 OR fx-CG50: DIST/BINOMIAL/Bpd/Variable

(a)(ii) $P(G \geq 5) = 1 - P(G \leq 4)$ $\begin{matrix} \leftarrow \leq 4 \rightarrow \\ \leftarrow \geq 5 \rightarrow \end{matrix}$
 (at least 5) $\begin{matrix} \text{...} \\ \text{3 4 5 6} \end{matrix}$ (1 mark)

$P(G \leq 4) = \left\{ \begin{matrix} \text{fx-991EX: MENU 7-Dist./Binomial CD/Variable} \\ \text{fx-CG50: DIST/BINOMIAL/Bcd/Variable} \end{matrix} \right\} = 0.53277 \dots$
 $1 - 0.53277 \dots = 0.4672 \dots = 0.467 \text{ 3sf} \quad (1 \text{ mark})$

(b) The next month, $G \sim B(300, 0.4)$
 (300 is a large no. and 0.4 is close to 0.5, so) $G \approx N(np, npq)$

(b)(i)
 where $np = \mu = 300 \times 0.4 = 120$ (1 mark)
 $npq = np(1-p) = \sigma^2 = 300 \times 0.4 \times 0.6 = 72$ (1 mark)