Question 10 (*H2:3; B2.3.2*)

$B(10, 0.5)$ is (a), $B(10, 0.25)$ is (b). The most obvious reason for this is that $B(10, 0.5)$ is a symmetric distribution, and $B(10, 0.25)$ is not. [*2*]

Question 11 (*H5:15.2, S4; B2.4*)

Because the $N(1,1)$ distribution allows a non-negligible amount of probability in the negative region and we know that this cannot occur. (In fact, if $X \sim N(1,1)$, then $P(X < 0) = \Phi(-1) = 0.1587$.) [*1*]

Question 12 (*H3:1; B3.1.1, 3.1.3*)

The mean is given by

$$E(X) = (-1)\tfrac{1}{3} + (0)\tfrac{1}{6} + (1)\tfrac{1}{2} = -\tfrac{1}{3} + \tfrac{1}{2} = \tfrac{1}{6};$$

The variance is given by

$$\begin{aligned} V(X) &= E\left[(X - \tfrac{1}{6})^2\right] \\ &= \left(-\tfrac{7}{6}\right)^2 \tfrac{1}{3} + \left(-\tfrac{1}{6}\right)^2 \tfrac{1}{6} + \left(\tfrac{5}{6}\right)^2 \tfrac{1}{2} \\ &= \tfrac{29}{36} = 0.806. \end{aligned}$$

Alternatively,

$$\begin{aligned} V(X) &= E(X^2) - \left(\tfrac{1}{6}\right)^2 \\ &= (-1)^2\tfrac{1}{3} + (0)^2\tfrac{1}{6} + (1)^2\tfrac{1}{2} - \tfrac{1}{36} \\ &= \tfrac{29}{36} = 0.806. \end{aligned}$$

[*3*]

Question 13 (*H3:4, S5; B3.3.2*)

$X \sim G(p = 0.06)$. Therefore, $E(X) = 1/p = 1/0.06 = 16.7$. Also, $V(X) = q/p^2 = (1-p)/p^2 = 0.94/0.06^2 = 261.1$. [*2*]

Question 14 (*H3:4, S5; B3.3.1*)

X = number of turns to get a six $\sim G(1/6)$. Therefore, $P(X \geq 4) = 1 - P(X \leq 3)$ $= 1 - \left(1 - (1 - \tfrac{1}{6})^3\right) = (5/6)^3 (= 125/216) = 0.579$. [*2*]

Question 15 (*H3:7, 3:8; B3.4.3, 3.5.1*)

For the upper quartile, solve $F(x) = x = 3/4$: i.e. $q_{0.75} = 3/4$. [*1*]

Question 16 (*Statistical common sense*)

You could *never* be *certain* of winning. [*1*]

Question 17 (*H4:7, 4:8, S4, S5; B4.4.1, 4.4.2*)

(a) $A \sim \text{Poisson}(4)$ (b) $B \sim M(2)$ [*4*]

Question 18 (*H4:1; B4.1.2*)

$P(X \leq 1) = P(X = 0) + P(X = 1) = 0.0907 + 0.2177 = 0.3084$. [*2*]

Question 19 (*H4:1, 4:4; B4.1.3, 4.3*)

(a) The mean and variance of a Poisson distribution are equal.

(b) The sum $X + Y + Z$ is Poisson with mean $(\mu_X + \mu_Y + \mu_Z)$ and therefore has variance $\mu_X + \mu_Y + \mu_Z$. [2]