

Binomial AS Exam Question

$$a) \quad X \sim B(40, 0.27)$$

$$P(X \geq 16) = 1 - P(X \leq 15)$$

$$= 1 - 0.9491$$

$$= \underline{0.0509}$$

$$b) \quad H_0 : p = 0.3 \quad \text{where } p \text{ is prob a} \\ H_1 : p \neq 0.3 \quad \text{randomly chosen person} \\ \quad \quad \quad \quad \quad \quad \text{buys a single tin}$$

$$c) \quad X \sim B(20, 0.3)$$

$$P(X \leq 2) = 0.0354 < 5\%$$

$$P(X \leq 3) = 0.107 > 5\%$$

$$P(X \leq 8) = 0.8866 \quad P(X \geq 9) = 0.1134 > 5\%$$

$$P(X \leq 9) = 0.952 \quad P(X \geq 10) = 0.048 < 5\%$$

Critical Region $\{0, 1, 2, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$

$$d) \quad \text{Actual significance} = 4.8\% + 3.54\% \\ = \underline{8.34\%}$$

e) 12 is in critical region

so manager's suspicions seem to be correct
the prob people buy a single tin is no
longer 30%

f) trials not independent. Scouts may
have more inclination to buy multiple tins
of a fast food to go camping. So
model probably not valid at this time

Full A-level Question

a) $H \sim B(10, 0.1)$

Prob of success constant each throw by each child
Throws independent of each other

b)
$$\begin{aligned} P(H \geq 4) &= 1 - P(H \leq 3) \\ &= 1 - 0.9872 \\ &= \underline{0.0128} \end{aligned}$$

c)
$$\begin{array}{l} \text{M M M M H} \quad \text{Miss, Hit} \\ 0.9^4 \times 0.1 = 0.06561 \end{array}$$

$$e) \quad P(F=n) = 0.01 + (n-1) \times a$$

$$P(F=1) = 0.01 + 0$$

$$P(F=2) = 0.01 + a$$

$$P(F=3) = 0.01 + 2a$$

⋮

$$P(F=10) = 0.01 + 9a$$

$$10 \times 0.01 + (a + 2a + \dots + 9a) = 1$$

$$0.1 + 45a = 1$$

$$45a = 0.9$$

$$a = \frac{0.9}{45} = \frac{1}{50} = 0.02$$

$$\underline{a = 0.02}$$

$$P(F=5) = 0.01 + 4 \times 0.02$$

$$\underline{= 0.09}$$