MEI STATISTICS 2 JANUARY 2007 Q3 POISSON

3 i) Sample mean $\bar{x} = \dfrac{53\times 0 + 20\times 1 + 6\times 2 + 1\times 3}{80} = 0.4375$

3 ii) $s = 0.6907 \Rightarrow s^2 = 0.4771$

Because the mean and variance are similar for the sample this suggests the Poisson (which has equal mean and variance) could be suitable to model this situation.

3 iii) $X \sim \text{Poisson}(0.4375)$

$P(X=1) = \dfrac{e^{-0.4375} \times 0.4375^1}{1!} = 0.2825$

Observed relative frequency for $X = 1$ was $\dfrac{20}{80} = 0.25$

so model seems reasonable.

3 iv) $X \sim \text{Poisson}(0.4375 \times 8)$

$X \sim \text{Poisson}(3.5)$

$P(X \geq 12) = 1 - P(X \leq 11)$

$= 1 - 0.9997 = 0.0003$

3v) The probability of ≥ 12 repairs is extremely low, so mean number of repairs is probably much higher. E1 E1

This could be due to launderette machines being used much more than household machines E1

MEI STATISTICS 2 JANUARY 2007 Q3 POISSON

3vi)

Washing Machine

$X \sim \text{Poisson}(0.4375)$

Tumble Drier

$Y \sim \text{Poisson}(0.15)$

A) $X+Y \sim \text{Poisson}(0.4375+0.15)$

$X+Y \sim \text{Poisson}(0.5875)$

$$P(X+Y)=3 = \frac{e^{-0.5875} \times 0.5875^3}{3!}$$

$$= 0.0188$$

B) $P(X=1) \cap P(Y=1) = \left(e^{-0.4375} \times 0.4375\right) \times \left(e^{-0.15} \times 0.15\right)$

$$= 0.0365$$