

CIMT Further Statistics P22 Ex 2C

1. $X = \text{no. of ropes that break under strain}$.

$$X \sim B(80, p)$$

we approximate X with normal distn, $Y \sim N(80p, 80pq)$ - this is allowed as $80p > 5$
 $80q > 5$

let $\frac{Y}{80} = \text{proportion of ropes that break}$

$$\Rightarrow \frac{Y}{80} \sim N(p, \frac{pq}{80})$$

we estimate p with $\hat{p} = \frac{12}{80}$

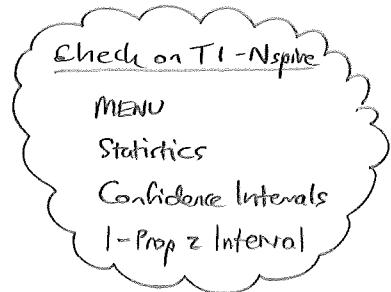
$$\text{so } 95\% \text{ CI for } p \text{ is } \hat{p} \pm 1.96 \times \sqrt{\frac{\hat{p}\hat{q}}{80}}$$

$$= \frac{12}{80} \pm 1.96 \times \sqrt{\frac{\frac{12}{80} \times \frac{68}{80}}{80}}$$

$$= 0.15 \pm 0.078245$$

$$= (0.071755, 0.228245)$$

$$\approx \underline{(0.072, 0.228)} \quad (\text{to 3dp})$$



2.

X = number of digits when error is made

$$X \sim B(1000, p)$$

approximate X with normal distribution, $Y \sim N(1000p, 1000pq)$ - allowed as $1000p > 5$
and $1000q > 5$ ✓

let $\frac{Y}{1000}$ = proportion of digits when error is made

$$\therefore \frac{Y}{1000} \sim N(p, \frac{pq}{1000})$$

we estimate p with $\hat{p} = \frac{19}{1000} = 0.019$

$$\text{so } 90\% \text{ CI for } p \text{ is } \hat{p} \pm 1.645 \sqrt{\frac{\hat{p}\hat{q}}{1000}}$$

$$= 0.019 \pm 1.645 \sqrt{\frac{0.019 \times 0.981}{1000}}$$

$$= (0.011899, 0.026101)$$

$$\approx \underline{(0.0119, 0.0261)} \text{ to 4dp.}$$

3. Let X = number of size 2 safety helmets.

from counting 29 out of 90 had size 2, so let $X \sim B(90, p)$

we approximate X with normally distributed $Y \sim N(90p, 90pq)$ - allowed as $\frac{90p}{90q} > 5$ ✓

let $\frac{Y}{90}$ = proportion with size 2

$$\text{so } \frac{Y}{90} \sim N(p, \frac{pq}{90})$$

we estimate p with $\hat{p} = \frac{29}{90}$

$$\text{so } 90\% \text{ CI for } p = \frac{29}{90} \pm 1.645 \times \sqrt{\frac{\hat{p}\hat{q}}{90}}$$

$$= (0.241196, 0.403249)$$

$$\approx (0.2412, 0.4032) \text{ to 4dp}$$