CIMT Further Statistics P32 Ex 2C

1. X = 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 $\frac{Y}{80}$ = proportion of ropes that break

so $\frac{Y}{80} \sim N\left(p, \frac{pq}{80}\right)$

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

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

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

$= 0.15 \pm 0.078245$

$= (0.071755, 0.228245)$

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

Check on TI-Nspire

MENU
Statistics
Confidence Intervals
1-Prop z Interval

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

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

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

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

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

$= (0.011899, 0.026101)$

$\approx (0.0119, 0.0261)$ 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 $90p > 5$, $90q > 5$ ✓

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

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

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

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

$= (0.241196, 0.403249)$

$\approx (0.2412, 0.4032)$ (to 4dp)