# Applied probability II supplemental exam

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Section B

1. (a)

$n = 10 \quad \mu = 79.2 \quad \sigma = 1.87$

90% CI, normal dist (reasonable assumption)

$N \sim (79.2, 1.87)$

z val = 1.645

$$\bar{x} \pm z \frac{\sigma}{\sqrt{n}}$$

$$79.2 \pm 1.645 \frac{1.87}{\sqrt{10}} = 80.17, 78.23$$

\# (78.23, 80.17)

We are 90% confident that $\mu$, the mean skull size lies between the interval (78.23, 80.17)

b) i) The CLT does not apply here because the random variable for the response from each person does not follow a binomial or bernoulli distribution

ii) The CLT applies here because the random variable for the total number of 'yes' responses from 1000 can be considered a linear combination of independent and identically distributed Bernoulli random variables

2. a) $\hat{y} = 71.83376 + 0.2862x$

b) brain size = 965 IQ = 90

predicted IQ = 71.833716 + 0.2862(965)
= 348.01676

Thus the residual for this data point is
90 − 348.01676 = −258.01676

c) The first comment is not reasonable as the residual is large which indicates the regression line is a poor fit for the data as the model over-predicts some values

The second comment is reasonable as we can see the residuals are large meaning that brain size and IQ are weakly correlated

3. $n = 10$ $\mu = 340.9$ $\sigma = 28.57135$

a) $H_0 : \mu < 360s$ $H_A : \mu \geq 360$

b) 1. gather a sample size n
→ n = 10, [331.7, 335, 338.1, 340.6 ... 383.9]
2. Draw a sample from original sample data with the same size n (10) and replicate B (200) times
→ sample = [338.1]
→ sample = [338.1, 331.7, 335, 338.1 ...]
3. Evaluate statistics for each sample and store
→ $\mu = 340.9$, $\sigma = 28.57135$
n. Repeat to create a bootstrap distribution of resampled statistics

c) $Z = (X - \mu)/\sigma$
$(10 - 340.9)/28.57135$
$= -11.58$

pval = sum (s >= s0)/N:
197/10 = 19.7

$197 / 10 = 19.7$