Durham University
MATH1541 Statistics
Exercise Sheet 15

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1 Q1

1.1 a) b)

$H_0 : \mu = 8.0$, $H_a : \mu \neq 8.0$
$p = \frac{8.6-8}{\frac{\sqrt{0.4}}{\sqrt{6}}} = 2.3237$
$P = 0.9797$
$\alpha = 5\%$, CV $= \pm 1.9600$, thus reject H_0
$\alpha = 1\%$, CV $= \pm 2.5758$, thus fail to reject H_0

1.2 c)

$X \sim \text{Bin}(1000, 0.01)$
$\text{E}(X) = 10$, $\text{Var}(X) = 9.9$
Therefore, over 1000 experiments, we would expect 10 to give us a Type I error.

2 Q2

2.1 a)

$H_0 : \mu = 2.0$, $H_a : \mu \neq 2.0$
$\alpha = 10\%$, t_{17} value $= 1.7396$
CI: $\mu \in [1.9 \pm 1.7396 \cdot \left(\frac{0.66}{\sqrt{18}}\right)]$
$2 \in [1.63, 2.17]$, thus fail to reject H_0

2.2 b)

The t-tables do not provide a value, at t_{17}, for the p-value of -0.6428.

3 Q7

3.1 a)

False - as per section 7.8 of the lecture notes, hypothesis tests should not be carried out on data that suggests a hypothesis ("many interesting, possibly significant, findings").

3.2 b)

False - as per section 7.5 of the lecture notes, when σ is unknown but the sample is large, any sampling distribution will be appropriate for use with a Normal-based test.

3.3 c)

True - as per section 7.5 of the lecture notes, when σ is unknown and n is small, a Normal sampling distribution is required to validate the use of the t distribution in hypothesis testing.

3.4 d)

False - a CI is not a random interval, therefore saying μ has a probability is nonsensical.

3.5 e)

True - the number of type I errors in n independent experiments where we carry out a hypothesis test at a 1% level of significance is distributed Bin(n, 0.01).

3.6 f)

False - 0.01 is the probability of a Type I error; that is, rejecting H_0 when it is actually true.

3.7 g)

True - this is how one performs a hypothesis test using the CI method.

3.8 h)

False - to hypothesis test at significance level $\alpha\%$, one must construct the $1-\alpha\%$ CI. Additionally, if the test statistic falls outside a CI, one would reject H_0.

3.9 i)

True, as per section 7.7 of the lecture notes; the same reasoning as for part e).