1. The $P$-value of a hypothesis test is:
   (a) The probability that $H_a$ is true.
   (b) The probability that $H_0$ is true.
   (c) Assuming $H_0$ is true, the probability that the test statistic takes a value as extreme or more extreme than the value actually observed.
   (d) Assuming $H_0$ is false, the probability that the test statistic takes a value as extreme or less extreme than the value actually observed.

At a large university, 400 randomly chosen women are selected at random and their heights are measured. The mean of these 400 women is 65.23 and their sample standard deviation is 3.41.

2. The standard deviation 3.41 given above is
   (a) The population $\sigma$.
   (b) The standard error of the mean
   (c) An estimate of $\sigma$.
   (d) A parameter of the $t$ distribution.

3. Which of the following formulas gives (approximately) a 90% confidence interval for $\mu$?
   (a) $65.23 \pm 1.65(3.41/400)$
   (b) $65.23 \pm 1.65(3.41/20)$
   (c) $65.23 \pm 2.0(3.41/20)$
   (d) $65.23 \pm 2.6(3.41/400)$

4. Which of the following statements is true?
   (a) An approximate 95% confidence interval for the population mean $\mu$ is $65.23 \pm 6.82$.
   (b) An approximate 95% confidence interval for the population mean $\mu$ is $65.23 \pm 0.34$.
   (c) We accept $H_0: \mu = 67$ tested against $H_a: \mu \neq 67$ at the 5% level.
   (d) Neither confidence intervals nor hypothesis tests are valid because the population may not be normal.

A simple random sample from a normal population yields the 95% confidence interval $24.11 \pm 2.32$ for $\mu$.

5. From this we know that a 99% confidence interval based on the same information:
   (a) Is shorter
   (b) Has larger df
   (c) Has smaller critical value
   (d) Has larger margin of error

6. From this we know that a two-sided test of $H_0: \mu = 25$ is:
   (a) Rejected at $\alpha = 5%$
   (b) Accepted at $\alpha = 5%$
   (c) Accepted at $\alpha = 1%$
   (d) Rejected at $\alpha = 10%$

   95% CI contains 25, so a two-sided test of $H_0: \mu = 25$ is Accepted at level 5%.

A sample of size 9 is taken from a normal population with unknown $\mu$ and $\sigma$ to do a two-sided test of a null hypothesis for $\mu$.

7. How many degrees of freedom (df) are there?  (a) 3  (b) 8  (c) 9  (d) 10  $df = n - 1 = 9 - 1 = 8$

8. What is the critical value $t^*$ for a 5% level test?  (a) 1.96  (b) 1.645  (c) 2.306  (d) 2.262

9. If the $t$ statistic is 2.5 then the $P$-value is closest to:  (a) 1%  (b) 2%  (c) 4%  (d) 8%

10. Which (if any) of the following samples has the largest mean and also the smallest standard deviation?
    (a) 46, 46, 47, 48, 49, 49  (b) 46, 48, 50, 52  (c) 50, 50, 50, 50, 50  (d) 46, 46, 52, 52
    Mean: 47.5  49  50  49
    SD: >0  >0  0  >0