

## Pharmacy 2012, Winter 2020, Stats Assignment 1 Solution

(Out of 50 points)

1. (Total 10 points) The length in cm. of 10 newborns are

41 40 38 38 38 32 33 38 30 34

- (2) (a) What is the mean length?  
Answer:  $\bar{X} = 36.2$  cm.
- (2) (b) What is the median length?  
Answer: *median* = 38 cm.
- (2) (c) What is the mode of the lengths?  
Answer: *mode* = 38 cm.
- (2) (d) What is the variance of the lengths?  
Answer:  $s^2 = 13.51$   
Note: sample variance is calculated as:

$$\begin{aligned} s^2 &= \frac{1}{n-1} \sum (X_i - \bar{X})^2 \\ &= \frac{1}{n-1} (\sum X_i^2 - n\bar{X}^2) \end{aligned}$$

- (2) (e) What is the standard deviation of the lengths?  
Answer:  $s = 3.68$  cm.

2. (Total 10 points) A sample of size 64 is chosen randomly from a population that can be described by a normal distribution with mean 12 and standard deviation 4.

- (6) (a) What is the sampling distribution for the sample mean? i.e., what is the shape, the mean and the standard deviation?  
Answer: The sampling distribution for the sample mean is also a normal distribution, the mean is 12 and the standard deviation (i.e., the standard error of the sample mean) is

$$4/\sqrt{64} = 0.5$$

(Each answer has 2 points. For the first one, it is OK to answer something like the sampling distribution is bell-shaped).

- (4) (b) If we choose a larger sample, what is the effect on the mean and standard deviation?  
Answer: The mean will remain the same; the standard deviation will be smaller. (Each answer has 2 points.)

3. (Total 20 points) If  $Z$  has a standard normal distribution:

- (2) (a) Find  $P(Z \leq -1.645)$ .  
(Note: you won't find the value -1.645 in the normal table, but you will find it at the bottom of the  $t$  table. Useful fact - the  $t$  distribution with infinite degrees of freedom is the standard normal distribution. Know how to use both the normal and  $t$  tables).  
Answer: .05 (by symmetry of  $t$  distribution, answer is the same as area to the right of 1.645, which is given in the table as .05)
- (2) (b) Find  $P(Z \leq 1.645)$ .  
Answer: .95 (= 1 - .05)
- (2) (c) Find  $P(Z > -1.645)$ .  
Answer: .95 (= 1 - .05)
- (2) (d) Find  $P(-1.645 < Z < 1.645)$ .  
Answer: .9 (= .95 - .05)
- (2) (e) Find  $P(|Z| \leq 1.645)$ .  
Answer: .9 (same as part (d))
- (2) (f) Find  $P(|Z| > 1.645)$ .  
Answer: .1 (= 1 - .9)
- (2) (g) What is the value of  $c$  for which  $P(Z > c) = .5000$ ?  
Answer: 0 (normal curve is symmetric about 0)
- (2) (h) What is the value of  $c$  for which  $P(Z \leq c) = .0202$ ?  
Answer: -2.05
- (2) (i) What is the value of  $c$  for which  $P(Z > c) = .1$ ?  
Answer: 1.28
- (2) (j) What is the value of  $c$  for which  $P(Z > c) = .2$ ?  
Answer: 0.84

4. (Total 10 points) A study was carried out where the objective of interest was the mean  $\mu$ .

- (2) (a) If the 95% confidence interval for  $\mu$  **contains** 7.3, then the 99% confidence interval for  $\mu$  will contain 7.3. (True, False, or insufficient information to decide.)  
Answer: True
- (2) (b) If the 95% confidence interval for  $\mu$  **contains** 7.3, then the 90% confidence interval for  $\mu$  will contain 7.3. (True, False, or insufficient information to decide.)  
Answer: Insufficient information to decide
- (2) (c) If the 95% confidence interval for  $\mu$  **contains** 7.3, then when testing the hypothesis  $H_0 : \mu = 7.3$  against the alternative  $H_a : \mu \neq 7.3$ , the p-value will be greater than .05. (True, False, or insufficient information to decide.)  
Answer: True

- (2) (d) If the 95% confidence interval for  $\mu$  **does not contain** 7.3, then when testing the hypothesis  $H_0 : \mu = 7.3$  against the alternative  $H_a : \mu \neq 7.3$ , the p-value will be less than .05. (True, False, or insufficient information to decide.)  
Answer: True
- (2) (e) If the 95% confidence interval for  $\mu$  **does not contain** 7.3, then when testing the hypothesis  $H_0 : \mu = 7.3$  against the alternative  $H_a : \mu \neq 7.3$ , the p-value will be less than .01. (True, False, or insufficient information to decide.)  
Answer: Insufficient information to decide