

Q.1. In a large scale study of SAR levels in cellphone models for 3 brands (LG, Motorola, Nokia), one characteristic reported was whether the model had low SAR levels. There were 457 total models studied, with  $P(LG) = 0.25$ ,  $P(Motorola) = 0.40$ , and  $P(Nokia) = .35$ . Among LG phones, the proportion with low SAR levels is 0.24, among Motorola, the proportion is 0.20, and among Nokia, the proportion is 0.28.

p.1.a. Compute the probability a randomly selected phone has a low SAR level.

12

Brand	$P(\text{BRAND})$	$P(\text{Low SAR}   \text{Brand})$	$P(\text{Brand} \cap \text{Low SAR})$
LG	.25	.24	$.25(.24) = .060$
M	.40	.20	$.40(.20) = .080$
N	.35	.28	$.35(.28) = .098$
	1		$P(LS) = .238$

p.1.b. Compute the probability of each brand, given the phone has a low SAR level.

9

$$P(LG | LS) = \frac{.060}{.238} = .252$$

$$P(N | LS) = \frac{.098}{.238} = .412$$

$$P(M | LS) = \frac{.080}{.238} = .336$$

Q.2. The lengths of a sample of 4 juvenile alligators measured in a study were (in cm): 96, 108, 131, 141.

Give the sample mean, median, and standard deviation of the lengths of the alligators (show all work).

$y$	$y - \bar{y}$	$(y - \bar{y})^2$	$S^2 = \frac{1278}{4-1} = 426$
96	-23	529	
108	-11	121	
131	12	144	
141	22	484	$S = \sqrt{426} = 20.64$
<hr/>		<hr/>	
Sum = 476		1278	$Med = \frac{108 + 131}{2} = \frac{239}{2} = 119.5$
Mean = 119			

Mean = 119      Median = 119.5      Std. Deviation = 20.64

39      (6)      (4)      (8)

Q.3. A movie preview is shown independently to  $n = 10$  people. Each person is then offered the chance to purchase a ticket. The probability any individual person, after seeing the preview, will buy the ticket is 0.4.

p.3.a. What is the probability that exactly 4 of the 10 buy the ticket?

$$\textcircled{6} Y \sim \text{Bin}(n=10, \pi=.4)$$

$$P(Y=4) = \frac{10!}{4!6!} (.4)^4 (.6)^6 = .2508$$

p.3.d. What is the mean and variance of the number of the 10 people to buy the ticket?

$$\textcircled{8} E\{Y\} = n\pi = 10(.4) = 4 \quad V\{Y\} = n\pi(1-\pi) = 10(.4)(.6) = 2.4 \quad \textcircled{5}$$

Q.4. During the years 1960-2015 the mean and standard deviation for July high temperatures at Orlando International airport were  $\mu_F = 91.4^\circ\text{F}$  and  $\sigma_F = 8.3^\circ\text{F}$ , respectively. You have friends arriving from a country that uses the Celsius system, where  $^\circ\text{C} = 0.56F - 17.78$ . Report to your friends the mean and standard deviation in terms of degrees Celsius.

$$\textcircled{6} \mu_C = 0.56\mu_F - 17.78 = 0.56(91.4) - 17.78 = 59.48 - 17.78 = 41.70$$

$$\textcircled{6} \sigma_C = 0.56\sigma_F = 0.56(8.3) = 4.648$$

Q.5. A researcher is interested in estimating the population mean length of adult female sharks of a particular species within 10 cm with 95% confidence. Based on published research on similar type sharks, she believes that the standard deviation is approximately 70 cm. How many sharks will she need to sample to have her margin of error = 10?

$$\textcircled{12} E = 10 = \frac{z_{\alpha/2} \sigma}{\sqrt{n}} = \frac{1.96(70)}{\sqrt{n}} = \frac{137.2}{\sqrt{n}}$$

$$\Rightarrow \sqrt{n} = \frac{137.2}{10} = 13.72 \Rightarrow n = (13.72)^2 = 188.24 \approx 189$$

Q.6. A random sample of  $n = 9$  women professional basketball players measured for Body Mass Index, resulted in a sample mean of 23.9 and sample standard deviation of 2.7. Complete the following parts, where  $\mu$  is the population mean among all women professional basketball players:

$$n = 9 \quad \bar{y} = 23.9 \quad s = 2.7$$

p.6.a. Compute the estimated standard error of the sample mean.

(6)

$$s_{\bar{y}} = \frac{s}{\sqrt{n}} = \frac{2.7}{\sqrt{9}} = \frac{2.7}{3} = 0.9$$

(3) p.6.b. Give the degrees of freedom corresponding to the answer in p.6.a.  $n-1 = 9-1 = 8$

p.6.c. Obtain a 95% confidence interval for  $\mu$

$$t(.025, 8) = 2.306$$

(10)

$$\begin{aligned} \bar{y} \pm t_{\alpha/2} \frac{s}{\sqrt{n}} &= 23.9 \pm 2.306(0.9) = 23.9 \pm 2.08 \\ &= (21.82, 25.98) \end{aligned}$$

p.6.d. Test  $H_0: \mu = 25$  versus  $H_A: \mu \neq 25$  at  $\alpha = 0.05$  significance level:

p.6.d.i. Test Statistic

$$t_{obs} = \frac{23.9 - 25}{0.9} = \frac{-1.1}{0.9} = -1.22$$

(8)

p.6.d.ii. Rejection Region:

$$|t_{obs}| \geq t(.025, 8) = 2.306$$

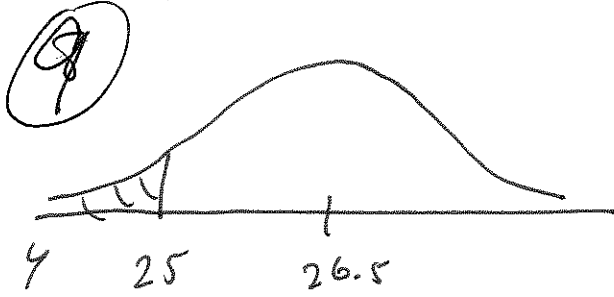
(5)

p.6.d.iii. P-value  $> 0.05$  or  $< 0.05$

(2)

Q.7. Body Mass Indices (BMI) for National Hockey League (NHL) players are approximately normally distributed with a mean of 26.50 and standard deviation of 1.45.

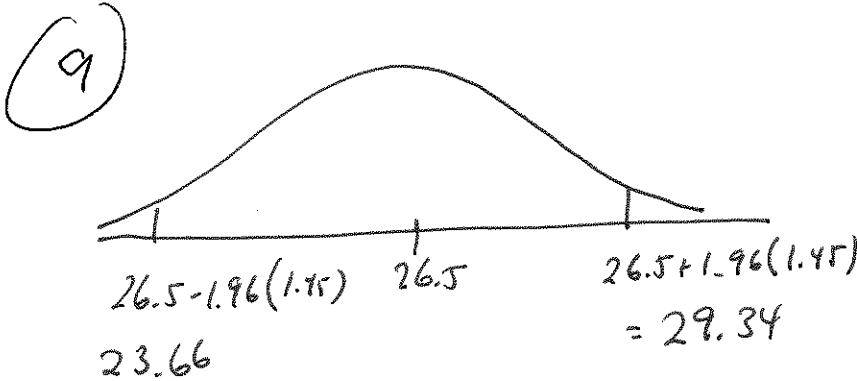
p.7.a. What is the probability a randomly selected NHL player has a BMI below 25.0?



$$P(Z \leq -1.03) = .1515$$

$$Z = \frac{-1.5}{1.45} = -1.03$$

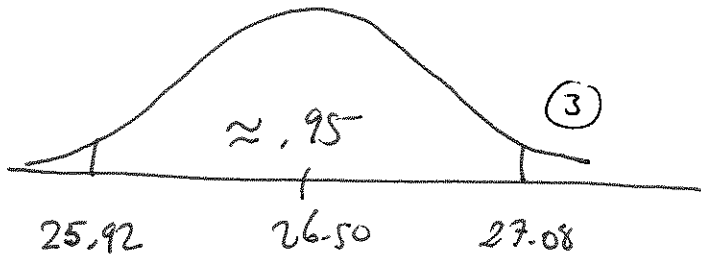
p.7.b. Between what 2 BMI levels do the middle 95% of all NHL players fall?



$$1.96(1.45) = 2.84$$

p.7.c. What is the sampling distribution of sample means of sample size = 25 from this population? Give the distribution symbolically and draw a graph of it.

$$\bar{Y} \sim N(\mu_{\bar{Y}} = 26.50, \sigma_{\bar{Y}} = \frac{1.45}{\sqrt{25}} = 0.29)$$



30