



AP[®] Statistics 2003 Sample Student Responses

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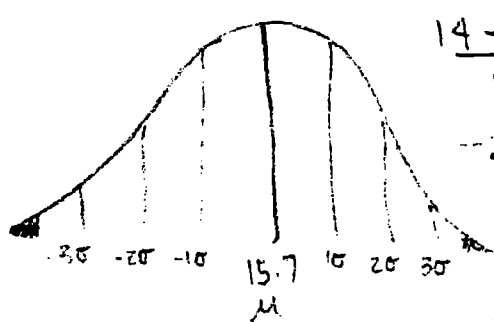
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3. Men's shirt sizes are determined by their neck sizes. Suppose that men's neck sizes are approximately normally distributed with mean 15.7 inches and standard deviation 0.7 inch. A retailer sells men's shirts in sizes S, M, L, XL, where the shirt sizes are defined in the table below.

Shirt size	Neck size
S	$14 \leq \text{neck size} < 15$
M	$15 \leq \text{neck size} < 16$
L	$16 \leq \text{neck size} < 17$
XL	$17 \leq \text{neck size} < 18$

A

- (a) Because the retailer only stocks the sizes listed above, what proportion of customers will find that the retailer does not carry any shirts in their sizes? Show your work.



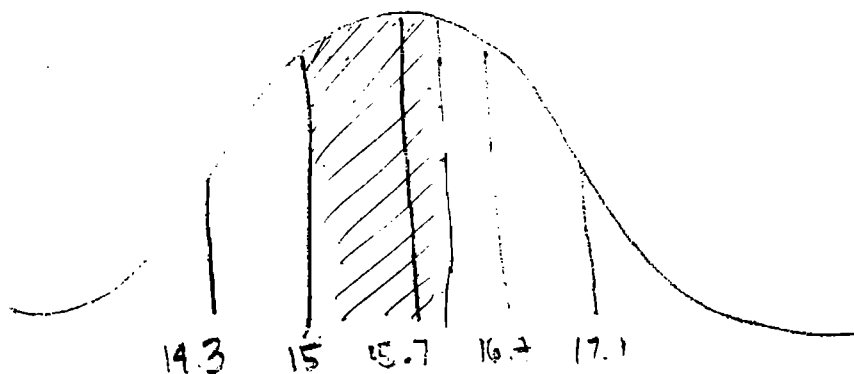
$$\frac{14 - 15.7}{0.7} < z < \frac{18 - 15.7}{0.7}$$

$$-2.43 < z < 3.29$$

$$P = .0005 - .9975 = .992$$

$$1 - P = \text{shirts not carried} = [.008]$$

- (b) Using a sketch of a normal curve, illustrate the proportion of men whose shirt size is M. Calculate this proportion.



$$\frac{15 - 15.7}{0.7} < z < \frac{16 - 15.7}{0.7}$$

$$-1 < z < .4286$$

$$P = .6628 - .1587$$

$$P = .5041$$

- (c) Of 12 randomly selected customers, what is the probability that exactly 4 will request size M? Show your work.

$$P(X=4) = \binom{12}{4} (.5041)^4 (.4959)^8$$

$$= 495 (.06457) (.003657)$$

$$= .1169$$

$$P = .12$$

Binomial setting

1. all observations are independent
2. either success or failure
3. all observations have probability, p , of success
4. fixed number for n

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B

- (a) Because the retailer only stocks the sizes listed above, what proportion of customers will find that the retailer does not carry any shirts in their sizes? Show your work.

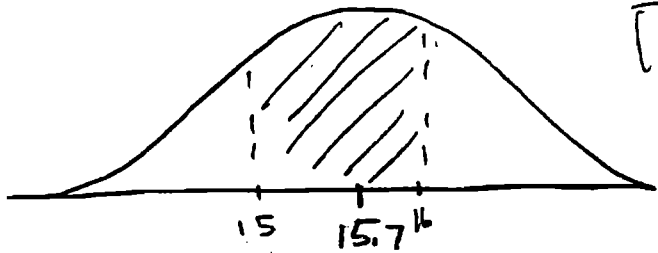
$$1 - \text{normalcdf}(14, 18, 15.7, 0.7) \approx \boxed{0.0081} = 0.81\%$$

I found the proportion of people within the necksize 14 to 18 because that is what retailers carry.

Subtracting from one to obtain the proportion that retailers do not carry, I found that .0081 of

population of customers are out of the range of shirt sizes that retailer carries.

- (b) Using a sketch of a normal curve, illustrate the proportion of men whose shirt size is M. Calculate this proportion.



$$\text{normalcdf}(15, 16, 15.7, 0.7) = \boxed{.5072}$$

OR

$$P(x < 16) = P\left(z < \frac{16 - 15.7}{.7}\right) = P(z < .429) = .6664$$

$$P(x < 15) = P\left(z < \frac{15 - 15.7}{.7}\right) = P(z < -1) = .1587$$

$$P(x < 16) - P(x < 15) = P(15 \leq x < 16) = .6664 - .1587 = \boxed{.5077}$$

-Scores -1 0 .429

- (c) Of 12 randomly selected customers, what is the probability that exactly 4 will request size M? Show your work.

$${}_{12}C_4 (.5072)^4 (.4928)^8 \approx \boxed{.11394} = 11.394\%$$

This is a binomial distribution with success probability of .5072, 12 trials, and expect exactly 4 successes.

$$\text{binompdf}(12, .5072, 4) = .11394$$

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