

Pencil and Paper Exercises on Sampling Statistics

2. The scores of individual students on the American College Testing Program (ACT), a university admission exam, follow the normal distribution with mean of 18.6 and a standard deviation of 5.9

- (a) What is the chance that a randomly selected student scores 21 points or higher?  
(b) The class average of one class of 81 students was  $m=20.4$ . What is the chance that the average of a randomly chosen group of 81 students would be 20.4 or higher.

ad(a)

$$\begin{aligned} z &= (x - \mu)/\sigma \\ &= (21 - 18.6)/5.9 \\ &= 2.4/5.9 \\ &= 0.41 \end{aligned}$$

From table for standard normal curve:

$$\begin{aligned} P(z \leq 0.41) &= 0.66 \\ P(0.41 \leq z) &= 1 - 0.66 = 0.34 \end{aligned}$$

averages of size  $n$  are distributed  $N(\mu, \sigma/\sqrt{n})$   
ave. of size 81 have mean =  $\mu = 18.6$ , SE =  $5.9/\sqrt{81} = 5.9/9 = 0.66$

ad(b)

$$\begin{aligned} z &= (x - \mu)/\sigma \\ &= (20.4 - 18.6)/0.66 \\ &= 1.8/0.66 \\ &= 2.7 \end{aligned}$$

From table for standard normal curve:

$$\begin{aligned} P(z \leq 2.7) &= 0.997 \\ P(2.7 \leq z) &= 1 - 0.997 = 0.0003 \end{aligned}$$