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Statistical Methods for the Biological,
Environmental, and Health Sciences
STAT 007

Answers to Quiz 4

1. Consider a test for a disease that is 90% reliable in the sense that if a person has the disease, there is a 0.9 probability that the test will give a positive response. Additionally, data indicate that the probability of having the disease is 0.01 and that the probability of having a positive test result is 0.108.

   What is the probability that a randomly selected person has the disease given that he/she had a positive response to the test?

$$P(disease \mid positive) = \frac{P(positive \mid disease)P(disease)}{P(positive)} \textbf{[1 pts]}$$
$$= \frac{0.9 * 0.01}{0.108} = 0.0833 \textbf{[2 pts]}.$$

2. Let x be a random variable that describes the number of children that a family has that can take the values 0, 1, 2, 3, and 4.

   The following table describes the probabilities of each possible value:

x	$P(x)$
0	0.25
1	-0.30
2	0.50
3	0.25
4	0.75

   Does the above table describe a probability distribution? Answer yes or no and provide 2 reasons for your answer.

   The above table does not describe a probability distribution **[1 pts]**. The sum of the probabilities is not 1**[1 pts]** ($\sum P(x) = 1.45$) and there is one probability that is negative **[1 pts]** ($P(1) = -0.3$).

3. Assume that adults have diastolic blood pressure measures that follow the normal distribution with a mean of 70.2 mm Hg and standard deviation of 10 mm Hg.

(a) An adult has normal diastolic blood pressure if it is less than 80 mm Hg. Compute the probability that a randomly selected adult has normal diastolic blood pressure.

Let x be a random variable that describes the diastolic blood pressure of an adult.

$$P(x < 80)\textbf{[1 pts]} = P(z < (80 - 70.2)/10) = P(z < 0.98)\textbf{[1 pts]}$$
$$= 0.8365$$

(b) An adult has Hypertension Stage 1 if he/she has diastolic blood pressure between 80 and 89. Compute the probability that a randomly selected adult has Hypertension Stage 1.

$$P(80 < x < 89)\textbf{[0.5 pts]} = P((89 - 70.2)/10 < z < (80 - 70.2)/10) = P(0.98 < z < 1.88)\textbf{[1 pts]}$$
$$= P(z < 1.88) - P(z < 0.98)\textbf{[1 pts]} = 09699 - 0.8365 = 0.1334\textbf{[0.5 pts]}$$