QUIZ 2-SOLUTIONS

King Fahd University of Petroleum & Minerals

Department of Mathematics & Statistics - STAT-319-Term071

Name: ID: Sec.: Serial:

Q1. The data from 200 machined parts are summarized as follows:

edge condition	**depth of bore**	
	above target	below target
coarse	15	10
moderate	25	20
smooth	50	80

a. What is the probability that a part selected has a moderate edge condition or a below-target bore depth?

Let M: part selected has a moderate edge condition

B: part selected has a below-target bore depth

$$P(M \text{ or } B) = P(M \bigcup B) = P(M) + P(B) - P(M \bigcap B)$$

$$= \frac{45}{200} + \frac{110}{200} - \frac{20}{200} = \frac{135}{200} = 0.675$$

(2-Points)

b. If a part selected has a moderate edge condition, what is the probability that it does not have a below-target bore depth?

$$P(B^{\backslash}|M) = \frac{P(B^{\backslash} \bigcap M)}{P(M)} = \frac{P(M) - P(B \bigcap M)}{P(M)} = \frac{\frac{45}{200} - \frac{20}{200}}{\frac{45}{200}} = \frac{25}{45} = \frac{5}{9} = 0.5556$$

(2-Points)

c. Let $\mathbf{E_1}$: the event that a part selected has a smooth edge condition, $\mathbf{E_2}$: the event that a part selected has above-target bore depth, are the two events independent? Explain.

No, because

$$P(E_1) = \frac{130}{200} = 0.65 \;,\; P(E_2) = \frac{90}{200} = 0.45, \quad P(E_1 \bigcap E_2) = \frac{50}{200} = 0.25$$

$$P(E_1) * P(E_2) = (0.65) * (0.45) = 0.2925 \neq 0.25 = P(E_1 \bigcap E_2)$$

(3-Points)

So, they are not independent.

Note: It can be proved using the conditional probability

Q2. An inspector working for a manufacturing company has a 99% chance of correctly identifying defective items and a 0.5% chance of incorrectly classifying a good item as defective. The company has evidence that its line produces 0.9% of nonconforming items. What is the probability that an item selected for inspection is classified as defective?

Let B_1: The selected item is defective $P(B_1) = 0.9\% = 0.009$

B_2: The selected item is defective $P(B_2) = 1 - 0.9\% = 1 - 0.009 = 0.991$

Let E: The item is classified as defective

$$P(E) = P(\mathrm{E}|\mathrm{B}_1)P(B_1) + P(\mathrm{E}|\mathrm{B}_2)P(B_2) = (0.99)(0.009) + (0.005)(0.991)$$

$$= 0.00891 \;+\; 0.004955 \;= 0.013865$$

(3-Points)

$$\simeq 0.0139$$