AP® Statistics
2003 Sample Student Responses
Form B

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A

2. A simple random sample of adults living in a suburb of a large city was selected. The age and annual income of each adult in the sample were recorded. The resulting data are summarized in the table below.

	Annual Income			
Age Category	$25,000-$35,000	$35,001-$50,000	Over $50,000	Total
21-30	8	15	27	50
31-45	22	32	35	89
46-60	12	14	27	53
Over 60	5	3	7	15
Total	47	64	96	207

(a) What is the probability that a person chosen at random from those in this sample will be in the 31-45 age category?

$$P(31\text{-}45 \text{ age}) = \frac{89}{207} \approx 0.43$$

(b) What is the probability that a person chosen at random from those in this sample whose incomes are over $50,000 will be in the 31-45 age category? Show your work.

$$P(31\text{-}45 \mid \text{over } \$50{,}000) = \frac{P(31\text{-}45 \text{ and over } \$50{,}000)}{P(\text{over } \$50{,}000)}$$

$$= \frac{35}{96}$$

$$= 0.365$$

(c) Based on your answers to parts (a) and (b), is annual income independent of age category for those in this sample? Explain.

Let A be the event of 31-45 age category
Let B be the event of over $50,000.

If, events A and B are independent, $P(A) = P(A|B)$

Based on my answers to parts (a) and (b), since

$$P(A) \neq P(A|B)$$
$$0.43 \neq 0.365$$

events A and B are not independent

Therefore, the annual income is not independent of age category for those in this sample.

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B

2. A simple random sample of adults living in a suburb of a large city was selected. The age and annual income of each adult in the sample were recorded. The resulting data are summarized in the table below.

	Annual Income			
Age Category	$25,000-$35,000	$35,001-$50,000	Over $50,000	Total
21-30	8	15	27	50
31-45	22	32	35	89
46-60	12	14	27	53
Over 60	5	3	7	15
Total	47	64	96	207

(a) What is the probability that a person chosen at random from those in this sample will be in the 31-45 age category?

The question is asking how many of the adults are counted in the age 31-45 out of all the adults in the sample.

$$\therefore P(\text{age } 31\text{-}45) = \frac{89}{207} = \underset{\text{(approximately)}}{0.43}$$

(b) What is the probability that a person chosen at random from those in this sample whose incomes are over $50,000 will be in the 31-45 age category? Show your work.

The question is asking how many of the adults are counted in the age 31-45 out of the adults with income of over $50,000.

$$\therefore P(\text{age } 31\text{-}45 \mid \text{over } \$50{,}000) = \frac{P(\text{age } 31\text{-}45 \cap \text{over } \$50{,}000)}{P(\text{over } \$50{,}000)} = \frac{35/207}{96/207} = \underset{\text{(approximately)}}{0.36}$$

(c) Based on your answers to parts (a) and (b), is annual income independent of age category for those in this sample? Explain.

if the age and the annual income were independent,

$P(A \mid B) = P(A)$ and $P(A \cap B) = P(A) \cdot P(B)$

where A : age 31-45
B : over $50,000

but $P(A \cap B) = \frac{35}{207} = 0.17$, and $P(A) \cdot P(B) = \frac{89}{207} \cdot \frac{96}{207} = 0.20$

$P(A \cap B) \neq P(A) \cdot P(B)$

therefore the annual income is not independent (dependent) with the age category.

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