

Quick Questions 8

Probability Part II Multiplication Rules

- I. Place the letter of the appropriate definition or formula next to the concept it defines.
 1. E 2. D or A 3. A or D 4. B 5. G 6. J 7. C 8. F 9. H 10. I
- II. Complete this chart concerning the number of hours students studied for a test and their exam grades.

Hours studying	<4	≥ 4	Total
Test score			
< 85	8	2	10
≥ 85	<u>2</u>	<u>8</u>	<u>10</u>
Totals	10	10	20

- III. Use a formula and the data in question II to answer the following questions.

- A. The probability of earning a grade less than 85.

$$P(< 85) = \frac{<85}{n} = \frac{10}{20} = .50 \rightarrow 50\%$$

- B. The probability of someone studying 4 or more hours and earning a grade of 85 or higher.

$$P(\geq 4 \text{ and } \geq 85) = P(\geq 4) P(\geq 85 | \geq 4) = \frac{10}{20} \times \frac{8}{10} = \frac{80}{200} = .40 = 40\%$$

- C. Was the special rule of multiplication applicable to question B? Why or why not?

The special rule for multiplication was not used because the events are not independent. The high percentage of grades ≥ 85 in the group that studied at least 4 hours indicates that studying affects grades. Because studying affects grades, it is the condition or given variable.

- D. Use Bayes' theorem to calculate the probability of someone who studied 4 or more hours scoring 85 or higher.

$$P(\geq 85 | \geq 4) = \frac{P(\geq 85 \text{ and } \geq 4)}{P(\geq 4)} = \frac{P(\geq 85) \times P(\geq 4 | \geq 85)}{P(\geq 85) \times P(\geq 4 | \geq 85) + P(< 85) \times P(\geq 4 | < 85)} = \frac{\frac{10}{20} \times \frac{8}{10}}{\frac{10}{20} \times \frac{8}{10} + \frac{10}{20} \times \frac{2}{10}} = \frac{\frac{80}{200}}{\frac{80}{200} + \frac{20}{200}} = \frac{.40}{.50} = 80\%$$

- E. Prove your answer to question D using the chart on page 50.

$$P(\geq 85 | \geq 4) = \frac{P(\geq 85)}{P(\geq 4)} = \frac{8}{10} = 80\%$$

- IV. How many stores will a salesperson visit if they must visit 3 locations in each of 4 cities?

$$\text{Number of stores} = MN = 3 \times 4 = 12$$

- V. An advertising manager has 6 advertisements of equal size to place horizontally across a magazine page.

- A. How many ways can the 6 ads be arranged?

$$N! = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720 \text{ possible arrangements}$$

- B. How many ways can 4 of the 6 ads be arranged if order counts?

$${}^N P_R = \frac{N!}{(N-R)!}$$

$${}^6 P_4 = \frac{6!}{(6-4)!} = \frac{6 \times 5 \times 4 \times 3 \times 2 \times 1}{2 \times 1} = 6 \times 5 \times 4 \times 3 = 360$$

- C. How many ways can 4 of the 6 ads be arranged if order does not count and a,b,c,d and d,c,b,a are considered the same arrangement?

$${}^N C_R = \frac{N!}{(N-R)!(R!)}$$

$${}^6 C_4 = \frac{6!}{(6-4)!4!} = \frac{6 \times 5 \times 4 \times 3 \times 2 \times 1}{2 \times 1 \times 4 \times 3 \times 2 \times 1} = \frac{6 \times 5}{2 \times 1} = 15$$