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## Ch. 4 - Part 2

- The Addition Rules for  
Probability.

# STAT. 110

جمال السعدي  
رياضيات - إحصاء



# Ch. 4 Part. 2

## The addition rules for probability

Two events are **mutually exclusive** events if they cannot occur at the same time they have no outcomes in common.

### Addition Rule 1

When two events A and B are mutually exclusive, the probability that A or B will occur is

$$P(A \cup B) = P(A) + P(B)$$

### Addition Rule 2

If A and B are not mutually exclusive, then

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

In a hospital unit there are 8 <sup>ممرض</sup>nurses and 5 <sup>طبيب</sup>physicians; 7 nurses and 3 physicians are females. If a staff person is selected, find the probability that the subject is a <sup>شخص</sup> person.

(1) Nurse or male.

(2) Physicians or females.

### Solution

Staff	Females	Males	Total
Nurses	7	1	8
Physicians	3	2	5
Total	10	3	13

(1) P (Nurse or male)

$$= P (\text{Nurse}) + P (\text{male}) - P (\text{nurse and male})$$

$$= \frac{8}{13} + \frac{3}{13} - \frac{1}{13} = \frac{10}{13}$$

(2) P (Physician or female)

$$= P (\text{Physician}) + P (\text{female}) - P (\text{Physician and female})$$

$$= \frac{5}{13} + \frac{10}{13} - \frac{3}{13} = \frac{12}{13}$$

2. Determine whether these events are mutually exclusive:

- a. Roll a die: Get an even number, and get a number less than 3.
- b. Roll a die: Get a prime number, and get an odd number.
- c. Roll a die: Get a number greater than 3,  
and get a number less than 3.
- d. Select a student in your class: The student has blond hair,  
and the student has blue eyes.
- e. Select a student in your college: the student is a  
طالب في السنة الثانية <sup>أشقر</sup> sophomore, and the student is a business major <sup>تخصص تجارة</sup>.
- f. Select any course: it is a calculus course,  
and it is an English course.
- g. Select a registered voter: the voter is a Republican <sup>الناخب جمهوري</sup>,  
and the voter is a democrat.

### Solution

(a)  $A = \{2,4,6\}$   $B = \{1,2\}$

$A \cap B = \{2\} \rightarrow$  not mutually exclusive.

(b)  $A = \{2,3,5\}$   $B = \{1,3,5\}$

$A \cap B = \{3,5\} \rightarrow$  not mutually exclusive.

(c)  $A = \{4,5,6\}$   $B = \{1,2\}$

$A \cap B = \phi \rightarrow$  A and B mutually exclusive.

(d) A: blond hair  $B =$  blue eyes

$A \cap B \neq \phi \rightarrow$  not mutually exclusive.

(e) A: sophomore  $B:$  business major

$A \cap B \neq \phi \rightarrow$  not mutually exclusive.

(f) A: calculus course

B: English course

 $A \cap B = \phi \rightarrow A$  and B mutually exclusive

(g) A: Republican

B: Democrat

 $A \cap B = \phi \rightarrow A$  and B mutually exclusive**Example:**

At a convention there are 7 mathematics instructors, 5 computer science instructors, 3 statistics instructors, and 4 science instructors. If an instructor is selected, find the probability of getting a science instructor or a math instructor.

**Solution**

Total instructors =  $7 + 5 + 3 + 4 = 19$

$P$  (science instructor or math instructor)

=  $P$  (science instructor) +  $P$  (math instructor)

$$= \frac{4}{19} + \frac{7}{19} = \frac{11}{19}$$

7. A recent study of 200 nurses found that of 125 female nurses, 56 had bachelor's degrees; and of 75 male nurses, 34 had bachelor's degrees. If a nurse is selected at random, find the probability that the nurse is

- A female nurse with a bachelor's degree.
- A male nurse.
- A male nurse with a bachelor's degree.
- Based on your answers to parts a, b, and c, Explain which is most likely to occur. Explain why.

### Solution

	Male	Female
Bachelor's degree	34	56
Without bachelor degree	$75-34 = 41$	$125-56 = 69$
Total	75	125

$$(a) P(A) = \frac{56}{200} = 0.28$$

$$(b) P(B) = \frac{75}{200} = 0.38$$

$$(c) P(C) = \frac{34}{200} = 0.17$$

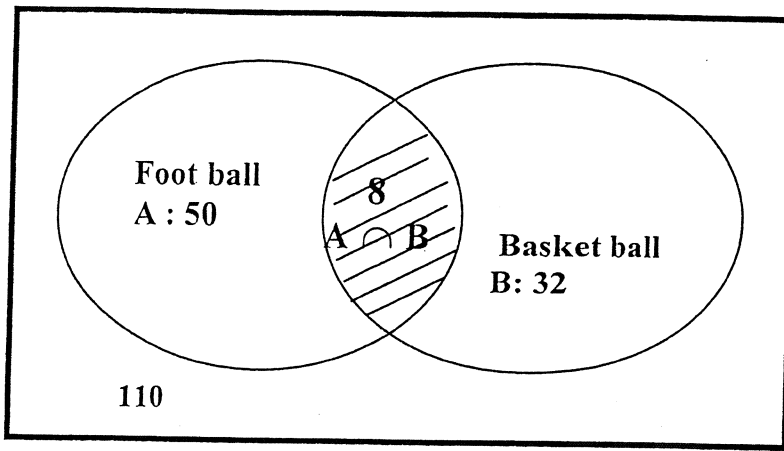
(d) Event B is most likely to occur

Because the probability is greater than any one.

9. At a particular school with 200 male students, 58 play football, 40 play basketball, and 8 play both.

What is the probability that a randomly selected male student?

- Plays neither sport.
- Plays (Football or Basketball).
- Plays (Football and Basketball).



$$a. P(\text{Play Neither sport}) = \frac{110}{200} = 0.55$$

$$b. P(\text{Play: Football or basketball})$$

$$= P(A \text{ or } B)$$

$$= P(A) + P(B) - P(A \cap B)$$

$$= \frac{58}{200} + \frac{40}{200} - \frac{8}{200} = \frac{90}{200} = 0.45$$

$$c. P(\text{Play: Football and basketball})$$

$$= \frac{8}{200} = 0.04$$

مركز تجاري لمقايضة السيارات

المخزن

13. The Bargain Auto Mall has these cars in stock.

متوسطة الحجم

	SUV	سيارة صغيرة Compact	متوسطة الحجم Mid – Sized
أجنبي Foreign	20	50	20
داخلي - وطني Domestic	65	100	45

If a car is selected at random, find the probability that it is:

- Domestic
- Foreign and mid – sized
- Domestic or an SUV.

### Solution

$$\text{Total cars} = 20 + 50 + 20 + 65 + 100 + 45 = 300$$

$$(a) \quad P(\text{Domestic}) = \frac{65 + 100 + 45}{300} = 0.7$$

$$(b) \quad P(\text{Foreign and mid – sized}) = \frac{20}{300} = 0.07$$

$$(c) \quad P(\text{Domestic or SUV})$$

$$= P(\text{Domestic}) + P(\text{SUV}) - P(\text{Domestic and SUV})$$

$$= \frac{65 + 100 + 45}{300} + \frac{20 + 65}{300} - \frac{65}{300} = 0.77$$

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25. An urn contains 6 red balls, 2 green balls, 1 blue ball and 1 white ball. If a ball is drawn, find the probability of getting:

(a) Red or green.

(b) blue or white

(c) not green

(d) blue and white

### Solution

$$\text{Total balls} = 6 + 2 + 1 + 1 = 10$$

$$(a) P(\text{red or green}) = P(\text{red}) + P(\text{green}) = \frac{6}{10} + \frac{2}{10} = \underline{\underline{0.8}}$$

$$(b) P(\text{blue or white}) = P(\text{blue}) + P(\text{white}) = \frac{1}{10} + \frac{1}{10} = \underline{\underline{0.2}}$$

$$(c) P(\text{not green}) = 1 - P(\text{green}) = 1 - \frac{2}{10} = \underline{\underline{0.8}}$$

$$(d) P(\text{blue and white}) = P(\phi) = \underline{\underline{0}}$$