

## Chapter 2: Economic Models

### SET THEORY

#### In-Class Worksheet 1

Which of the following statements are valid?

1. (a)  $A \cup A = A$  (d)  $A \cup U = U$  (g) The complement of  $\bar{A}$  is A.  
(b)  $A \cap A = A$  (e)  $A \cap \emptyset = \emptyset$   
(c)  $A \cup \emptyset = A$  (f)  $A \cap U = A$

2. Given the sets  $S_1 = \{2, 4, 6\}$ ,  $S_2 = \{7, 2, 6\}$ ,  $S_3 = \{4, 2, 6\}$ , and  $S_4 = \{2, 4\}$

$$S_4 \cap S_2 \cap S_1$$

$$S_3 \cup S_1 \cup S_4$$

3. If  $U = \{1, 3, 5, 7, 9, 11, 13\}$ , then which of the following are subsets of U.

$$B = \{2, 4\}$$

$$A = \{0\}$$

$$C = \{1, 9, 5, 13\}$$

$$D = \{5, 11, 1\}$$

$$E = \{13, 7, 9, 11, 5, 3, 1\}$$

$$F = \{2, 3, 4, 5\}$$

4. Let  $A = \{2, 3, 4, 5, 6, 7\}$   $B = \{2, 4, 7, 8\}$   $C = \{2, 4\}$ . Fill in the blanks by  $\subset$  or  $\not\subset$  to make the resulting statements true.

(a)  $B \_ A$

(b)  $C \_ A$

(c)  $B \_ C$

(d)  $\emptyset \_ B$

(e)  $C \_ C$

(f)  $C \_ B$

5. Write all the subsets for the following.

(a)  $\{3\}$

(b)  $\{6, 11\}$

(c)  $\{2, 5, 9\}$

(d)  $\{1, 2, 6, 7\}$

(e)  $\{a, b, c\}$

(f)  $\emptyset$

(g)  $\{p, q, r, s\}$

6. If  $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{2, 4, 6, 8\}$

$B = \{3, 5, 7\}$

$C = \{1, 5, 7, 8, 9\}$

Find (a)  $A'$  (b)  $B'$  (c)  $C'$

7. Let  $P = \{3, 5, 7, 9, 11\}$   $Q = \{9, 11, 13\}$   $R = \{3, 5, 9\}$   $S = \{13, 11\}$

Write Yes or No for the following.

(a)  $R \subset P$

(b)  $Q \subset P$

(c)  $R \subset S$

(d)  $S \subset Q$

(e)  $S \subset P$

(f)  $P \not\subset Q$

(g)  $Q \not\subset R$

(h)  $S \not\subset Q$

8.  $U = \{10, 20, 30, 40, 50, 60\}$

$A = \{10\}$

$B = \{10, 40, 60\}$

(a)  $A \cup B =$

(b)  $A \cap B =$

(c)  $(A \cap B)^c =$

(d)  $(A \cup B)^c =$

(e) Is  $A \subset B$ ?

9. In a group of 60 people, 27 like cold drinks and 42 like hot drinks and each person likes at least one of the two drinks. How many like both cold drinks and hot drinks?

10. In a group of 100 persons, 72 people can speak English and 43 can speak French. How many can speak English only? How many can speak French only and how many can speak both English and French?

11. Let A and B be two finite sets such that  $n(A) = 20$ ,  $n(B) = 28$  and  $n(A \cup B) = 36$ , find  $n(A \cap B)$ .

12. 24 dogs are in a kennel. 12 of the dogs are black, 6 of the dogs have short tails, and 15 of the dogs have long hair. There is only 1 dog with a short tail that is **not black** and **does not have long hair**. 2 of the dogs are black with short tails and **do not have long hair**. 2 of the dogs have short tails and long hair but are **not black**. All of the dogs in the kennel have at least one of the mentioned characteristics.

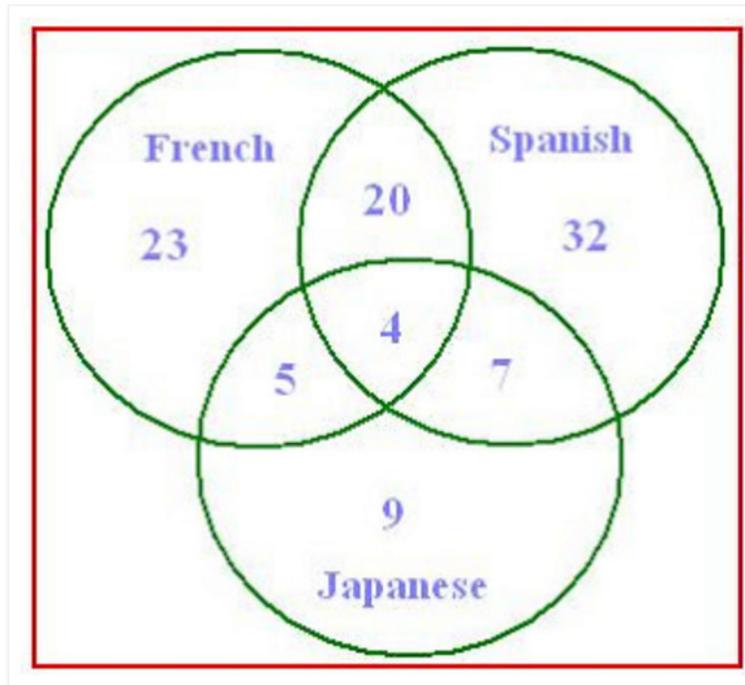
(a) How many dogs have all three characteristics?

(b) How many dogs are black with long hair but do not have short tails?

(c) How many dogs are black only?

*(Hint: Draw a Venn diagram of three sets – Black, Short tails and Long Hair. Let  $x$  equal to the number of dogs that are black with long hair, but do not have short tails.)*

13. The Venn diagram below displays the survey results of a 100 adults who were asked whether they had studied French, Spanish or Japanese in school. The numbers indicate the number of people who studied the subject(s).



- (a) How many people studied Spanish?
- (b) Spanish but not French?
- (c) Japanese but not French?
- (d) French or Spanish?
- (e) French and Spanish but not Japanese?

14. There are 35 students in art class and 57 students in dance class. Find the number of students who are either in art class or in dance class when:

- (a) two classes meet at different hours and 12 students are enrolled in both activities.
- (b) two classes meet at the same hour.