**1. ENTAILMENTS**

For each pair of sentences below, determine whether the first sentence (a.) entails the second (b.).

(1) a. Leo ate waffles for breakfast this morning.

b. Leo ate breakfast this morning.

(2) a. Leo ate something with syrup for breakfast.

b. Leo ate waffles for breakfast.

(3) a. Leo ate chicken and asparagus last night.

b. Leo ate something hot last night.

(4) a. Leo ate neither chicken nor asparagus last night.

b. Leo didn’t eat chicken last night.

(5) a. Maria and Marco are married.

b. Maria and Marco are married to each other.

(6) a. Maria is married to Marco.

b. Marco is married to Maria.

(7) a. Marco loves Maria.

b. Maria loves Marco.

(8) a. Roberto is a teacher at UConn.

b. Roberto is a Linguistics teacher.

(9) a. John went for a drive in his new car.

b. John bought a car recently.

(10) a. John didn’t buy flowers yesterday.

b. John didn’t spend money at a a florist yesterday.

(11) a. John didn’t buy flowers.

b. John’s wife didn’t get flowers from him.

(12) a. John didn’t buy flowers.

b. John lost his wallet.

(13) a. John didn’t buy flowers yesterday.

b. John didn’t buy tulips yesterday.

(14) a. Yesterday, I watched TV at least for three hours.

b. Yesterday, I didn’t watch TV for more than three hours.

(15) a. Some student passed the final.

b. Not every student passed the final.

**2. SET THEORY**

(1) Notational convention:

Uppercase letters are used to refer to sets: A, B, C ...

Lowercase are used for the members: a, b, c ... x, y, z

(2) a. a is a member of the set B   
 Notation: a  B

b. a is not a member of the set B  
 Notation: a  B

(3) Number of elements in a set: *cardinality* of the set.  
“The cardinality of S” is written |S|.

Example: |A| = 9  
 |N| = ∞

(4) a. *The empty set—*

Definition: the set with no members

b. *The universe of discourse*: U

Definition: the set containing everything

(5) Sets are unordered and an object can only be an element of a set once.

a. The set of odd natural numbers less then ten

A = {1, 3, 5, 7, 9} or A = {1, 5, 9, 7, 3} …

b. The set of letters in the word “Mississippi”

B = {M, i, s, p}

(6) There are three ways to specify the members of a set. Given a set C of even natural numbers less than 9:

1. 2 C, 4  C, 6  C, 8  C

2. List them between curly brackets

e.g.: C = {2, 4, 6, 8} (the set whose members are 2, 4, 6, 8.)

3. Give property all the members share

e.g.: C = {x: x is a natural even number less than 9}

(7) *Subset* relation

Set A is a subset of set B if and only if every member of A is a member of B.

Notation: A  B

(8) *Intersection:*

A ∩ B = the set that contains all the members common to A and B.

= {x: x A & x  B}

**EXERCISE B**

List the members of the following sets.

a. The set of words in the sentence *The boy with the cat liked the pudding with bananas.*

b. The set of letters in your first name

c. The set of natural numbers more than 60 and less than 65

d. The set of even positive integers more than 60 and less than 62

e. The set of States of the U.S. which begin with ‘C’

**EXERCISE C**

Express the sets below in a different notation (there could be several ways of doing so).

A = {5, 10, 15, 20, 25, 30, 35, 40, …}

B = {x: x a State of the United States that does not border any other US State}

C = {344, 346, 348, 350, 352}

D = {Belarus, Belgium, Bosnia, Bulgaria}

E = {2, 3, 5, 7, 11, 13, 17, 19}

F = {x: x is a course you are currently taking}

**EXERCISE D**

Suppose our world contains the following sets:

S = {x: x swims}

D = {x: x is a downhill skier}

B = {x: x is a basketball player}

The members of these sets are:

U = {Ben, Christine, Dragan, Goran, Jonathan, Kai, Leo, Nancy, Susi, Uli}

S = {Ben, Christine, Jonathan, Kai, Leo, Nancy, Susi, Uli}

D = {Jonathan, Kai, Leo, Susi, Uli}

B = {Ben, Dragan, Goran, Uli}

Correct the errors in the following statements:

i. Ben S

ii. Ben, Dragan ∈

iii. Ben D

iv. |S| = 7

v. |S| > |U|

Determine whether each of the following statements is true or false.

a. S U d. B S

b. D U e. S B

c. B U f. D S

g. {Ben, Uli} S

h. {Ben, Uli} D

i. {Ben, Uli} B

j. {Christine, Dragan} S

k. {Christine, Dragan} D

l. {Christine, Dragan} B

m. {Christine, Dragan} U

**ENTAILMENTS**

State how entailments are defined in terms of sets.

A entails B, if and only if:

**3. SEMANTIC RULES**

**Semantic Rule I (p. 185)**

The meaning of [**S NP VP**] is the following **truth condition**:

If the meaning of **NP** (an individual) is a member of the meaning of **VP** (a set of individuals), then **S** is **TRUE**, otherwise it is **FALSE**.

**Semantic Rule II (p. 185)**

The meaning of [**VP V NP**] is the set of individuals X such that X is the first member of any pair in the meaning of V whose second member is the meaning of NP.

***EXERCISE A***

Assume the following individuals and their relation to the following activities:

*Tom sleeps, runs, scorns Matthew and Anthony, and visited Vienna.*

*Matthew sleeps, scorns Tom and Anthony, and visited Berlin and Vienna.*

*Anthony acts, likes Tom and Matthey, and visited Vienna, Boston and Los Angeles.*

**A.** Give the meaning (reference) of the following items:

〚*Tom*〛 =

〚*sleeps*〛 =

〚*acts*〛 =

〚*visited*〛 =

〚*scorns*〛 =

**B.** Draw a tree representing the semantic values of the components of each of the following sentences. State which rules need to be applied to correctly compute the meaning. Follow the example given below.

a. *Tom acts.*

b. *Anthony runs.*

c. *Matthew scorns Anthony.*

d. *Anthony scorns Tom.*

e. *Tom visited Vienna.*

f. *Matthew visited Los Angeles.*

Example: *Tom sleeps.*

S 〚VP〛= {Tom, Matthew} **RULE II**

〚NP〛= {Tom} **REFERENCE**

NP VP 〚S〛= TRUE **RULE I**

*Tom sleeps*