

1.

- a) Randy Goldberg is enrolled in the class CS 252.
- b) There is a class in which Carol Sitea is enrolled.
- c) There is a student who is enrolled in both Math 222 and CS 252.
- d) There is a student that is not Mary Black that is enrolled in all the classes which Mary Black is enrolled in.

2. a)

Domain for x: all students in this class

Domain for y: all countries in the world

Predicate:  $V(x,y)$  : "x has visited y"

Statement A:  $\exists x \forall y V(x,y)$

**Negation:**

$$\neg(\exists x \forall y V(x,y))$$

$$\equiv \neg \exists x \forall y V(x,y)$$

$$\equiv \forall x \neg \forall y V(x,y)$$

$$\equiv \forall x \exists y \neg V(x,y)$$

In English: Everyone in this class has not visited some country in the world.

b)

Domain for x: all people

Domain for y: all mountains in the Himalayas

Predicate:  $C(x,y)$  : "x climbed y"

Statement B:  $\forall x \exists y \neg C(x,y)$

Negation:

$$\neg(\forall x \exists y \neg C(x,y))$$

$$\equiv \neg \forall x \exists y \neg C(x,y)$$

$$\equiv \exists x \neg \exists y \neg C(x,y)$$

$$\equiv \exists x \forall y \neg(\neg C(x,y))$$

$$\equiv \exists x \forall y C(x,y)$$

In English: There is someone that has climbed every mountain in the Himalayas.

c)

Domain for x: all faculty members at my school

Domain for y: all children from Berekuso Basic School

Predicate:  $M(x,y)$  : "x mentored y"

Statement C:  $\forall x \exists y M(x,y)$

Negation:

$$\neg(\forall x \exists y M(x,y))$$

$$\equiv \neg \forall x \exists y M(x,y)$$

$$\equiv \exists x \neg \exists y M(x,y)$$

$$\equiv \exists x \forall y \neg (M(x,y))$$

$$\equiv \exists x \forall y \neg M(x,y)$$

In English: There is a faculty member who has not mentored all children from Berekuso Basic School.

3.

Let P: "Maria is cooking."

Q: "Maria is hungry."

R: "Maria will go jogging."

$$\neg P \vee Q$$

$$Q \rightarrow \neg R$$

$$P \vee \neg R$$

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$$\therefore \neg R$$

|     | Step  | Reason                                   |
|-----|---|--|
| 1.  | $\neg P \vee Q$                               | Premise                                  |
| 2   | $Q \rightarrow \neg R$                        | Premise                                  |
| 3.  | $P \vee \neg R$                               | Premise                                  |
| 4.  | $\neg Q \vee \neg R$                          | Conditional disjunction equivalence on 2 |
| 5.  | $(P \vee \neg R) \wedge (\neg P \vee Q)$      | Conjunction on 3 and 1                   |
| 6.  | $(\neg R \vee Q)$                             | Resolution on 5                          |
| 7.  | $(Q \vee \neg R)$                             | 1 <sup>st</sup> Associativity Law on 6   |
| 8.  | $(Q \vee \neg R) \wedge (\neg Q \vee \neg R)$ | Conjunction on 7 and 4                   |
| 9.  | $\neg R \vee \neg R$                          | Resolution on 8                          |
| 10. | $\neg R$                                      | 1 <sup>st</sup> Idempotent Law on 9      |

$\therefore$  The premises imply the conclusion “Maria will not go jogging.”