

INFO I201 Homework 7

Due 06/04.

- **Reading assignment:** Sections 4.1-4.3.
- **Computer problems:** 3.1-3.8.
- **Regular problems:**

1. Use set builder notation to give a description of each of these sets.

- $\{0, 3, 6, 9, 12\}$
- $\{-3, -2, -1, 0, 1, 2, 3\}$
- $\{1, 3, 5, 7, \dots\}$

2. Suppose that $A = \{2, 4, 6\}$, $B = \{2, 6\}$, $C = \{4, 6\}$, and $D = \{4, 6, 8\}$. Determine which of these sets are subsets of which other of these sets.

3. Determine whether each of these statements is true or false:

- $0 \in \emptyset$
- $\{0\} \subseteq \emptyset$
- $\emptyset \in \{\emptyset\}$
- $\{\emptyset\} \in \{\emptyset\}$
- $\{\{\emptyset\}\} \subseteq \{\{\emptyset\}, \{\emptyset\}\}$
- $\emptyset \in \{\emptyset, \{\emptyset\}\}$

4. What is the cardinality of each of these sets?

- \emptyset
- $\{\emptyset\}$
- $\{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}$
- $\mathcal{P}(\{a, b, \{a, b\}\})$
- $\mathcal{P}(\mathcal{P}(\emptyset))$
- $\mathcal{P}(\{\emptyset\})$

5. Determine whether each of these sets is the power set of a set.

- \emptyset
- $\{\emptyset, \{a\}\}$
- $\{\emptyset, \{a\}, \{\emptyset, a\}\}$

6. Consider the following language: \mathcal{L} : Constants: m , Predicate Symbols: $B(x, y), S(x, y)$, Function Symbols: $f(x)$.

Decide if each expression below is a formula:

- $S(m, x)$
- $\forall x \exists y S(x, f(y))$
- $B(m, f(m))$
- $f(m)$
- $B(B(m, x), y)$
- $(B(x, y) \longrightarrow (\exists z S(z, y)))$
- $B(f(f(x)), S(m, x))$

7. Consider the language we discussed in class, namely the language \mathcal{L} : Constants: P, J , Predicate Symbols: $H(x, y), L(x, y)$, Function Symbols: $F(x)$.

Decide if each expression is a term:

- $H(x, L(x, y))$
- $F(F(F(x)))$
- $L(F(x), F(F(P)))$
- P

Decide if each of the following expressions is a formula:

- $P \wedge J$
- $\forall x L(x, F(y))$
- $L(P, H(P, J))$
- $F(L(x, P)) \wedge F(J)$

8. Let $P(x, y)$ be the statement “student x has taken class y ”. Express each of the formulas below in English:

- (a) $\exists x \exists y P(x, y)$
- (b) $\exists x \forall y P(x, y)$
- (c) $\forall x \exists y P(x, y)$
- (d) $\exists y \forall x P(x, y)$
- (e) $\forall x \forall y P(x, y)$

9. Let $C(x, y)$ mean “student x is enrolled in class y ”. Express each of the formulas below in simple English:

- (a) $C(\text{Randy}, \text{CS201})$
- (b) $\exists y C(\text{Carol}, y)$
- (c) $\exists x (C(x, \text{M222}) \wedge C(x, \text{I201}))$