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Comp 3240

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Hw 4

4.1.1

a) True

b) False

c) True

d) False

e) True

f.) False

g.) False

4.1.3

- a) $\mathbb{Z} \subset \mathbb{R}$ is true
- b) $\mathbb{Z} \subseteq \mathbb{R}$ is true
- c) $\mathbb{Z} \subseteq \mathbb{R}^+$ is false
- d) $\mathbb{N} \subset \mathbb{R}$ is true
- e) $\mathbb{Z} \subset \mathbb{N}$ is false

4.2.1

- a) $2 \in x$ is true
- b) $\{2\} \subseteq x$ is true
- c) $\{2\} \in x$ is false
- d) $3 \in x$ is false
- e) $\{1, 2\} \in x$ is true
- f) $\{1, 2\} \subseteq x$ is true
- g) $\{2, 4\} \subseteq x$ is true
- h) $\{2, 4\} \in x$ is false
- i) $\{2, 3\} \subseteq x$ is false
- j) $\{2, 3\} \in x$ is false
- k) $|x| = 7$ is false

4.3.1

a) $A \cup B = \{-12, -5, -3, 0, 1, 4, 6, 17\}$

All elements of set A and B

b) $A \cap B = \{1, 4\}$, both sets

c) $A \cap C = \{-3, 1, 17\}$ set A are odd

d) $A \cup (B \cap C) = A \cup \{-5, 1\} = \{-3, 0, 1, 4, 17\} \cup \{-5, 1\}$
 $= \{-5, -3, 0, 1, 4, 17\}$

e) $A \cap B \cap C = \{1\}$

f.) $A \cup C = \{\dots, -7, -5, -3, 0, 1, 3, 4, 5, 7, 9, 11, 13, 15, 17, \dots\}$
AUC is an infinite set.

g.) $(A \cup B) \cap C = (A \cup B) = \{-12, -5, -3, 0, 1, 4, 6, 17\}$
 $(A \cup B) \cap C = \{-5, -3, 1, 17\}$ is an infinite set.

h.) $A \cup (C \cap D) = C \cap D = \{1, 3, 5, 7, 9, 11, 13, 15, 17, \dots\}$
A \cup (C \cap D) is an infinite set.

4.4.4

- a.) $|A \cap B| = 1$ is false
- b.) $\{1, 2\} \subseteq P(A)$ is a true statement
- c.) $G \subseteq H$ is a true statement
- d.) $|C - F| = 1$ is a false statement
- e.) $A \cup B = A \oplus B$ is a true statement
- f.) $|E \cap B \cap C|$ is a false statement
- g.) $\emptyset \in C$ is a false statement
- h.) $\{\{O\}\} \subseteq P(c)$ is a true statement
- i.) $C \cap F = C \cap G$ is a true statement
- j.) $E \cup F \subseteq R$ is a true statement
- k.) $\emptyset \in P(B)$ is always a true statement

4.5.1

a) $(B \cap C) \cup \overline{B \cap C} = U \rightarrow$ Complement law: $A \cup \overline{A} = U$

b) $A \cup (A \cap B) = \overline{A} \rightarrow$ Absorption law: $A \cup (A \cap B) = A$

c) $A \cup (\overline{B \cap C}) = A \cup (\overline{B} \cup \overline{C}) \rightarrow$ De Morgan's law: $(\overline{A \cap B}) = (\overline{A} \cup \overline{B})$

d) $(B \cap \overline{\overline{C}}) = B \cap C \rightarrow$ Double complement law: $(\overline{\overline{A}}) = A$

e) $(B - A) \cup (B - A) = (B - A) \rightarrow$ Idempotent law: $A \cup A = A$

f.) $((A \oplus B) - C) \cap \emptyset = \emptyset \rightarrow$ law of \emptyset : $A \cap \emptyset = \emptyset$

4.5.2

a) $(A \cap C) \cup (A \cap \bar{C})$

$= (A \cup A) \cap C \rightarrow$ Distributive law

$= C \cap C \rightarrow$ Complement law

$= C \rightarrow$ Identity law

b) $(B \cup A) \cap (\bar{B} \cup A)$

$= (B \cap \bar{B}) \cup A \rightarrow$ Distributive law

$= \emptyset \cup A \rightarrow$ Complement law

$= A \rightarrow$ Identity law

c) $A \cap \bar{B}$

$= \bar{B} \cup \bar{A} \rightarrow$ De Morgan's law

$= B \cup \bar{A}$

$= \bar{A} \cup B$

d) $\bar{A} \cap (A \cup B)$

$= (\bar{A} \cap A) \cup (\bar{A} \cap B) \rightarrow$ Distributive law

$= \emptyset \cup (\bar{A} \cap B) \rightarrow$ Complement law

$= \bar{A} \cap B \rightarrow$ Identity law

e) $\bar{A} \cup (A \cap B)$

$= (\bar{A} \cup A) \cap (\bar{A} \cup B) \rightarrow$ Distributive law

$= U \cap (\bar{A} \cup B) \rightarrow$ Complement law

$= (\bar{A} \cup B) \rightarrow$ Identity law

f.) $A \cap (B \cap \bar{B}) = \emptyset$

$= (A \cap \emptyset) \rightarrow$ Complement law

$= \emptyset$

g. $A \cup (B \cup \bar{B}) = U$

4. b.1

a) $\{(tall, foam, non-fat), (tall, no-foam, non-fat),$
 $(grande, foam, non-fat), (grande, no-foam, non-fat),$
 $(venti, foam, non-fat), (venti, no-foam, non-fat),$
 $(tall, foam, whole), (tall, no foam, whole),$
 $(grande, foam, whole), (grande, no foam, whole),$
 $(venti, foam, whole), (venti, no foam, whole)\}$

b) $\{(foam, tall, nonfat), (foam, grande, non-fat),$
 $(foam, venti, non-fat), (no foam, tall, non-fat),$
 $(no foam, grande, non-fat), (no foam, venti, non-fat),$
 $(foam, tall, whole), (foam, grande, whole),$
 $(foam, Venti, whole), (no foam, tall, whole),$
 $(no foam, grande, whole), (no foam, venti, whole)\}$

c) $\{(foam, non-fat), (foam, whole), (nofoam, nonfat),$
 $(nofoam, whole)\}$

#4.6.3

- a) $R^2 \subseteq R^3$ is false
- b) $Z^2 \subseteq B^2$ is true
- c) $Z^2 \cap Z^3$ is true
- d) if $A \subseteq B$ then $A^2 \subseteq B^2$ is true
- e) if $A \subseteq B$ then $A \times C \subseteq B \times C$ is true

4.7.1

a) No, A, B, C don't form the partition of D

$$A \cap B = \{1, 2, 4\} \cap \{2, 3, 6\} \\ = \{2\} \neq \emptyset$$

b) No, B and C don't form partition of D

$$B \cup C = \{2, 3, 4\} \cup \{5\} \\ = \{2, 3, 4, 5\} \neq D$$

c) Yes, B and C do partition E

$$B \cup C = \{2, 3, 4\} \cup \{5\} = \{2, 3, 4, 5\} = E$$