Discrete Math- HW3

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Section 2.1

6a. The set of all people who speak English with an Australian accent are a subset of people who speak English

6b. The set of citrus fruits are a subset of fruits.

6c. Neither are subsets of each other.

11a. False

11b. False

11c. False

11d. True

11e. False

11f. False

11g. True

12a. True

12b. True

12c. False

12d. True

12e. True

12f. True

12g. False

13a. True

13b. True

13c. False

13d. True

13e. True

13f. False

22a. 0

22b. 1

22c. 2

22d. 3

24. Yes

25a. 8

25b. 16

25c. 2

Section 2.2

2a. $A \cap B$

2b. $A - B$

2c. $A \cup B$

2d. $\overline{A} \cup \overline{B}$

4a. $A \cup B$={a,b,c,d,e,f,g,h}

4b. $A \cap B = \{a, b, c, d, e\}$

4c. $A - B = \{\emptyset\}$

4d. $B - A = \{f, g, h\}$

16e. $A \cup (B - A) = A \cup B$
Have to show $A \cup (B - A) \subseteq A \cup B$
$x \in A \vee x \in B - A$
$x \in A \vee (x \in B \wedge \neg(x \in A))$
$x \in A \vee x \in B$
$x \in A \cup B$
Also have to show $A \cup B \subseteq A \cup (B - A)$
$x \in A \cup B$

$x \in A \vee x \in B$

$x \in A \vee (x \in B \wedge \neg(x \in A))$

$x \in A \vee x \in B - A$

This proves $A \cup (B - A) = A \cup B$

38. $A \oplus B = \{2, 5\}$

41. $A \oplus B = \{x | x \in A \vee x \in B \wedge \neg(x \in A \wedge x \in B)\}$
$= \{x | x \in A \cup B\} \wedge \neg(x \in A \cup B)\}$
$= \{x | x \in (A \cup B) - (A \cap B)\}$
This proves that $A \oplus B = (A \cup B) - (A \cap B)$

Section 2.3

3a. f is not a function. A bit string could start with more than one zero, which would lead to multiple images

3b. f is a function

3c. Not a function. If there is a string of zeros no value is assigned.

4a. Domain: **N**
Range: $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

4b. Domain: $\mathbf{N} - \{0\}$
Range: $\mathbf{N} - \{0, 1\}$

4c. Domain: All bit strings
Range: **N**

4d. Domain: All bit strings
Range: **N**

10a. 1:1

10b. Not 1:1

10c. Not 1:1

14a. Onto

14b. Not onto

14c. Onto

14d. Onto

14e. Not onto

23a. Bijection

23b. Not a bijection

23c. Bijection

23d. Not a bijection

32a. $\{..., -4, -2, 0, 2, 4, ...\}$

32b. $\{0, 2, 4, 6, 8, ...\}$

32c. **R**

36. $g(x) = g(y)$
$= f(g(x)) = f(g(y))$
$= f \circ g(x) = f \circ g(y)$
$= x = y$
This proves that g is a one to one function

37. $g : A \to B$
$f : B \to C$
$f(g(x)) : A \to C$
$A = \{q, r\}$
$B = \{s, t\}$
$C = \{v\}$
Here, g(q) = g(r) = s, and f(s) = f(t) = v. This means that f and f∘g is onto, but g is not, as it doesn't map to all values of B.

Section 2.5

1c. Countably infinite
$f(x) = 100 - n$
$= \{99, 98, 97, ...\}$

1d. Uncountable

1f. Countably infinite
$f(x) = 7x$
$= \{..., -14, -7, 0, 7, 14, ...\}$

2d. Uncountable

2e. Countably infinite
$\{2,1\},\{2,2\},\{2,3\},...$
$\{3,1\},\{3,2\},\{3,3\},...$

2f. Countably infinite
$f(x) = 10x$
$..., -20, -10, 0, 10, 20, ...$

3b. Countable

3d. Uncountable

4c. Uncountable

4d. Uncountable

10a. $A = \mathbf{R}$
$B = \mathbf{R}$

10b. $A = \mathbf{R}$
$B = \mathbf{R}$ not containing 1

10c. $A = \mathbf{R}$
$B = \mathbf{Q}$

Sundry

a. Jeannie Ren- jr3766
Alush Benitez- alb2331

b. `https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols`

c. Roughly 12 hours

d. 5