Solutions for the third week's homework
Math 131

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Also available as PDF.

1 Section 1.4, problem 54

According to the percentages, Primestar has 16% of 12 million or 1.92 million. C-Band then has 15% or 1.8 million. Primestar has 120 thousand more subscribers.

However, the slices appear of drastically different sizes. I suspect the satellite dish is tilted "upwards" like a real dish, distorting the slices' areas.

2 Section 2.1

2.1 Problems 1-8

1. C
2. G
3. E
4. A
5. None of the above! They meant B, but $1 = 2^0$ is a positive integer and a power of two. The authors meant "two raised to the power of each of the five least positive integers". *I hadn't realized this at first, or else I would not have given this one.*
6. D
7. H
8. F

2.2 Problems 11 and 17

11. $\{0,1,2,3,4\}$
17. $\{2,4,8,16,32,64,128,256\}$

2.3 Problems 30 and 32

30. $\{x|x$ is an even natural number$\}$ is a direct translation, but $\{2x|x \in \mathbb{J}^+\}$ is shorter. Another possibility is $\{x|x > 0, x$ is an even integer$\}$.
32. One form is $\{35 + 5i|i \in \mathbb{J}, 0 \leq i \leq 12\}$.

2.4 Problems 62, 63, and 66

62. $-12 \notin \{3,8,12,18\}$.
63. $0 \in \{-2,0,5,9\}$.
66. $\{6\} \notin \{3,4,5,6,7\}$. But note that $\{6\} \subset \{3,4,5,6,7\}$.

2.5 Problems 68, 71, 74, and 78

68. false
71. true
74. true
78. true (assuming a typical meaning for "…")

2.6 Problem 92

Part a. Three chocolate bars are contain a total of 660 calories. The point of this exercise is to ensure you recognize that sets are unordered, so $\{r,s\} = \{s,r\}$ and you only include it once. The list is as follows: $\{r\}$, $\{r,s\}$, $\{r,c\}$, $\{r,g\}$, $\{r,v\}$, $\{s,c\}$, and $\{s,g\}$.

Part b. Five bars is 1100 calories. The list is $\{r,s,v\}$, $\{r,s,g\}$, $\{r,s,c\}$, $\{r,c,v\}$, $\{r,c,g\}$, and $\{r,g,v\}$.

3 Section 2.2

3.1 Problems 8, 10, 12, 14

8. $\{M,W,F\} \not\subset \{S,M,T,W,Th\}$.
10. $\{\mathrm{a,n,d}\} \subset \{\mathrm{r,a,n,d,y}\}$.

12. $\emptyset \subset \emptyset$.
14. $\{2, 1/3, 5/9\} \subset \mathbb{Q}$.

3.2 Even problems 24-34

24. true
26. false
28. false
30. true
32. false
34. false

4 Section 2.3

4.1 Problems 1-6

1. B
2. F
3. A
4. C
5. E
6. D

4.2 Problems 10, 17, 18, 23, 24

10. $Y \cap Z = \{b, c\}$.
17. $X \cup (Y \cap Z) = \{a, b, c, e, g\}$.
18. $Y \cap (X \cup Z) = \{a, b, c\} = Y$ because $Y \subset X \cup Z$.
23. $X \setminus Y = \{e, g\}$.
24. $Y \setminus X = \{b\}$.

4.3 Problem 31

The set consisting of all the elements of A along with those elements of C that are not in B.

4.4 Problem 33

The set consisting of elements in A but not in C as well as elements in B but not in C. If we consider the union of A, B, and C to be the universal set, then this is the set of all elements in A complement along with all elements in B complement.

4.5 Problems 61, 62

61. $X \cup \emptyset = X$, and the conjecture is that the union of any set with the empty set is the set itself.
62. $X \cap \emptyset = \emptyset$, and the conjecture is that the intersection of any set with the empty set is the empty set.

4.6 Problems 72, 73

72. $A \times B = \{(3,6),(3,8),(6,6),(6,8),(9,6),(9,8),(12,6),(12,8)\}$
$B \times A = \{(6,3),(8,3),(6,6),(8,6),(6,9),(8,9),(6,12),(8,12)\}$
73. $A \times B = \{(d,p),(d,i),(d,g),(o,p),(o,i),(o,g),(g,p),(g,i),(g,g)\}$.
$B \times A = \{(p,d),(i,d),(g,d),(p,o),(i,o),(g,o),(p,g),(i,g),(g,g)\}$, alas, no pigdog in sight.

4.7 Problems 117, 118, 121-124

117. $A \setminus B = A$ implies that $A \cap B = \emptyset$.
118. $B \setminus A = A$ is true only when $B = A = \emptyset$.
121. If $A \cup \emptyset = \emptyset$, then $A = \emptyset$.
122. $A \cap \emptyset = \emptyset$ for any set A.
123. If $A \cap \emptyset = A$, then $A = \emptyset$.
124. $A \cup \emptyset = A$ for all sets A.