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CS-225: Discrete Math in CS
Homework 3 Part 2
Exercise Set 6.1, Problem# 3, 7, 13, 18, 33, 34

3.

a) No, R is not a subset of T. There are elements in R that are not in T, such as 2 and 4. T is actually a subset of R.

b) Yes, T is a subset of R. All the elements in T are in R. This is due to 2 being a factor of 6.

c) Yes, T is a subset of S. All the elements in T are in S. This is because 3 is a factor of 6.

7.

a) No, A is not a subset of B. There are elements in A that are not in B, such as x=10. For B to have y=10, b would have to equal 2/3, which is not an integer.

b) Yes, B is a subset of A. All elements of B appear in A. Suppose n is any element of B, such that n=18b-2 for any integer b. For A, let a=(3b-1), then x=6a+4 = 6(3b-1)+4 = 18b-6+4 = 18b-2. That is the value of n in B and proves every element of B is in A.

c) Yes, B and C are equal. Suppose n is any element of C, such that n=18c+16 for any integer c. For B, let b=c+1, then y = 18b-2 = 18(c+1)-2 = 18c+18-2 = 18c+16. This is the value of n in C. Now suppose m is any element of B, such that m=18b-2 for any integer b. For C, let c=b-1, then z = 18c+16 = 18(b-1)+16 = 18b-18+16 = 18b-2. This is the value of m in B. This proves sets B and C are equal.

13.

a) True, all integers are rationals

b) False, negative irrationals are not in the rational set

c) False, rational numbers that are not integers are not part of the integer set

d) False, x=0 is an element of the Z set, but not the set of positive or negative integers

e) True, no integer can be both positive and negative, so it is an empty set

f) True, all Q is in R, but not all R is in Q, therefore Q is the limiting factor

g) True, all Z is in Q, so every element is found in Q

h) True, all Z^+ are in R, but not all R are in Z^+, so Z^+ is the limiting factor

i) False, all Z is in Q, so every element is found in Q. Z is missing elements for (Z or Q)

18.

a) No, 0 is an element and there are no elements in an empty set

b) No, $\emptyset$ is an empty set, and $\{\emptyset\}$ is a set with one element, $\emptyset$

c) Yes, $\{\emptyset\}$ is a set with one element. That element is $\emptyset$

d) No, Ø is an empty set with no elements. If $\emptyset \in \emptyset$, then $\emptyset$ would have an element.

33.

a) $P(\emptyset) = \{\emptyset\}$

b) $P(P(\emptyset)) = P(\{\emptyset\}) = \{\emptyset,\{\emptyset\}\}$

c) $P(P(P(\emptyset))) = P(\{\emptyset,\{\emptyset\}\}) = \{\emptyset,\{\emptyset\},\{\{\emptyset\}\},\{\emptyset,\{\emptyset\}\}\}$

34.

a) A_1 x (A_2 x A_3) = A_1 x ((u,m),(u,n),(v,m),(v,n)) = ((1,(u,m)),(2,(u,m)),(3,(u,m)),(1,(u,n)),(2,(u,n)),(3,(u,n)),(1,(v,m)),(2,(v,m)),(3,(v,m)),(1,(v,n)),(2,(v,n)),(3,(v,n)))

b) (A_1 x A_2) x A_3 = ((1,u),(1,v),(2,u),(2,v),(3,u),(3,v)) x A_3 = (((1,u),m),((1,v),m),((2,u),m),((2,v),m),((3,u),m),((3,v),m),((1,u),n),((1,v),n),((2,u),n),((2,v),n),((3,u),n),((3,v),n))

c) A_1 x A_2 x A_3 = ((1,u,m),(1,v,m),(2,u,m),(2,v,m),(3,u,m),(3,v,m),(1,u,n),(1,v,n),(2,u,n),(2,v,n),(3,u,n),(3,v,n))