CS441 – Discrete Structures for Computer Science
Instructor: Dr.Litman

Problem from Section 2.1

28. In each case, the answer is a set of 3-tuples.
b).
{(0,x,a), (0,x,b), (0,x,c), (0,y,a), (0,y,b), (0,y,c), (1,x,a), (1,x,b), (1,x,c), (1,y,a), (1,y,b), (1,y,c)}

d).
{(x,x,x), (x,x,y), (x,y,x), (x,y,y), (y,x,x), (y,x,y), (y,y,x), (y,y,y)}

Problem from Section 2.2

2.
a). $A \cap B$
b). $A \cap B'$ or $A - B$
c). $A \cup B$
e). $A' \cup B'$

4. Note that A is a subset of B.
a) {a,b,c,d,e,f,g,h}=B
b) {a,b,c,d,e}=A
c) φ (There are no elements in A that are not in B)
d) {f,g,h}

6.
a) $A \cup \phi = \{ x \mid x \in A \ V \ x \in \phi \ \} = \{ x \mid x \in A \ V \ \mathbf{F} \ \} = \{ x \mid x \in A \} = A$
b) $A \cap U = \{ x \mid x \in A \ \Lambda \ x \in U \} = \{ x \mid x \in A \ \Lambda \ \mathbf{T} \ \} = \{ x \mid x \in A \} = A$

14.
A=(A-B) U (A∩B), A = {1,3,5,6,7,8,9}. Similarly, B= (B-A) U (A∩B), B = {2, 3,6,9,10}.

50.
a) 00 1110 0000 b). 10 1001 0001 c). 01 1100 1110

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Problem from Section 2.3

2.
a) No (Rule is not very well defined. We do not know whether f(3)=3 or f(3)=-3).
b)Yes (For all integers n, $\sqrt{(n^2+1)}$) is a well-defined real number.)
c) No (f(n) is undefined for n=2 and n=-2).

4.
a) Domain: Set of nonnegative integers and Range: set of digits (0 thru 9)
b) Domain: Set of positive integers and Range: set of integers greater than 1.
c) Domain: Set of all bit strings and Range: Set of nonnegative integers.
d) Domain: Set of all bit strings and Range: Set of nonnegative integers.(bit string can have length 0)

8.
a) 1
b) 2
c) -1
d) 0
e) 3
f) -2
g) 1
h) 2

10.
a) Yes
b) No (Since b is the image of both a and b.)
c) No (Since d is the image of both a and d.)

14.
a) Yes (f(0,-n)= n for every integer n)
b) No (Since 2 is not in the range.)
c) Yes (Since f(0,n-1)=n for every integer n.
d) Yes (To achieve negative values we set m=0 and for nonnegative values we set n=0)
e) No

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Problem from Section 2.3

18.
a) Yes (Since inverse function is (4-x)/3)
b) No (Not one-to-one as f(17)=f(-17), for instance and also not onto.)
c) No (This is bijection, but not from R to R. And x=-2 is not in the domain and x=1 is not in range(Inverse not defined). It is a bijection from R-{-2} to R-{1} and its inverse clearly is (1-2x)/(x-1))
d) Yes (It is clear that this function is increasing throughout its domain (R) and it takes on both arbitrarily large values and arbitrarily small values (large negative) values. So it is a bijection. Its inverse is clearly $(x-1)^{1/5}$.)

32.
Given: $f(x) = x^2+1$ and $g(x) = x + 2$. $(f \circ g)(x) = f(x+2) = (x+2)^2 +1 = x^2+4x+5$, whereas $(g \circ f)(x) = g(f(x)) = g(x^2+1) = X^2+3$. Note that they are not equal.