HW 4 CprE 310

Jacob Boicken

1.) i.) is a function, each x is mapped to only one $1/x$

ii.) isn't a function, not every real number x maps to a real number $\sqrt{x}$ ie $-1 \to i$.

iii.) isn't a function, X maps to multiple numbers, ie $1 \to -\sqrt{2}$ and $1 \to \sqrt{2}$

2.) one to one: $f(x) = f(y)$ then $x = y$ for every $x, y \in Z$

(i) $x-1 = y-1 \to x = y$ so it is one to one

(ii) Both -1 & 1 map to 2 so it is NOT one to one

(iii) $x^3 = y^3 \to \sqrt[3]{x^3} = y \to x = y$ so it is one to one

(iv) if $n = 1$ then it is mapped to $1/2$ which isn't the codomain (Z) so it is NOT one to one in the domains

3.) onto: $f(a,b) = c$ for every a, b, c in Z

(i) $a+b = c \to a = c$ $b = 0$ $\to$ then we get $c = c$ so every c is the image for $f(c,0)$ so it is onto

(ii) $a^2 - b^2 = c \to c = 2$ $a^2 = b^2 + 2$
However, no squared ints have a difference of 2 so this is NOT onto.

(iii) $a = c \to$ map a equal to $c \to c = c$
so when $a = c$ every $c \in Z$ is mapped so it onto

(iv) $|a| - |b| = c \to a = c$ $b = 0 \to |c| = c \to c = c$
so it is onto

4.) $f(x) = x^2 + 1$ $g(x) = x + 2$

(i) $f \circ g = f(g(x)) = f(x+2) = (x+2)^2 + 1 = x^2 + 4x + 5$

(ii) $g \circ f = g(f(x)) = g(x^2+1) = x^2 + 3$

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5.)	reflexive	symmetric / anti sym	transitive
a.)	true	neither	true
b.)	true	symmetric	false
c.)	false	symmetric	false
d.)	false	antisymmetric	false
e.)	true	symmetric	false
f.)	false	neither	true

6.)	reflexive	sym / anti-sym	transitive
a.)	false	symmetric	false
b.)	true	symmetric	false
c.)	true	symmetric	true
d.)	false	antisymetric	false
e.)	true	symmetric	true
f.)	false	symmetric	false
g.)	false	antisymmetric	false
h.)	false	symmetric	false

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7.) $((a,b),(c,d)) \in R \leftrightarrow a+d=b+c$

Reflexive: $((a,b),(a,b)) \in R$ is true since $a+b=a+b$

Symmetric: $a+d=b+c$ & $c+b=d+a$ are equivalent
so $((a,b),(c,d)) \in R$ and $((c,d),(a,b)) \in R$ are true

Transitive: If $a+d=b+c$ and $c+f=d+e$

then $a+\cancel{d}+\cancel{c}+f = b+\cancel{c}+\cancel{d}+e$
$\rightarrow a+f = b+e$

so $((a,b),(c,d)) \in R \wedge ((c,d),(e,f)) \in R$
$\rightarrow ((a,b),(e,f)) \in R$

8 Partitions of $\{1,2,3,4,5,6\}$?

a.) false c.) true

b.) true d.) false

9.)

a.) In a tournament, players don't face against themselves so they can't "beat" themselves so no cycles of 1. As well, players only face each other once so it impossible to have more than one "beaten" edge/relation between two players so we can't have cycles of 2.

b.) asymmetric: always - impossible for two players to beat eachother in one match and can't face yourself

reflexive: never - can't compete against yourself

irreflexive: always - can't win against yourself

transitive: sometimes - it is possible that player y beats all the players x beat if y beats x

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10.) a.) Reflexive: The same word shares the first letter with itself. ie "the" R "the" works.

Symmetric: Two words share the same first letter regardless of order. ie "the" R "to" and "to" R "the" both work.

Transitive: Three words starting with same letter all work in the relation together. ie if "the" R "to" and "to" R "tuned" both work, then "the" R "tuned" works.

b.) Equivalence classes: (Ignoring case so "The" and "the" are the same)

[0] = {the, television, tuned, to}

[1] = {above, a}

[2] = {sky}

[3] = {port}

[4] = {was}

[5] = {color, channel}

[6] = {of}

[7] = {dead}