Class: COMP 3040 - Foundation of Computer Science
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Homework 1

Homework 1: Basics And Using Latex

0.1

(a) A set of all odd natural numbers.

(b) A set of all even integer number.

(c) A set of all even natural numbers.

(d) A set of all even natural numbers that are multiples of 6.

(e) A set of all symmetric binary numbers.

(f) A set of all odd integer numbers.

0.2

(a) {1, 10, 100}

(b) {n ∈ Z | n > 5}

(c) {n ∈ N | n < 5}

(d) {aba}

(e) {} or ε

(f) ∅

0.3 Let A be the set {x,y,z} and B be the set {x,y}.

(a) **Is A a subset of B?**
No. $A \not\subset B$.

(b) **Is B a subset of A?**
Yes. $B \subset A$.

(c) **What is A ∪ B?**
$A \cup B = \{x,y,z\}$.

(d) **What is A ∩ B?**
$A \cap B = \{x,y\}$.

(e) **What is A × B?**
$A \times B = \{(x,x),\ (x,y),\ (y,x),\ (y,y),\ (z,x),\ (\ z,y)\}$

(f) **What is the power set of B?**
$P(B) = \{\emptyset,\ \{x\},\ \{y\},\ \{x,y\}\}$

0.4 If A has *a* and B has *b* elements, how many elements are in $\boldsymbol{A \times B}$? Explain your answer.

Each element in A is paired with each element in B, so there will be a × b elements.

0.5 If C is a set with c elements, how many elements are in the power set of C? Explain your answer.

The power set of C |P(C)| has 2^c elements. Because the formula to determine a power set is $|P(C)| = 2^c$, where C is a set and c is a number elements of the set.

0.6

(a) f(2) = 7

(b) Domain f = {1, 2, 3, 4, 5} and Range f = {6,7}

(c) g(2, 10) = 6

(d) Domain g = $\{(x,y) \in N \times N \mid 1 \leq x \leq 5, 6 \leq y \leq 10\}$
Range g = {6, 7, 8, 9, 10}

(e) g(4,f(4)) = g(4,7) = 8

0.7 For each part, give a relation what satisfies the condition.

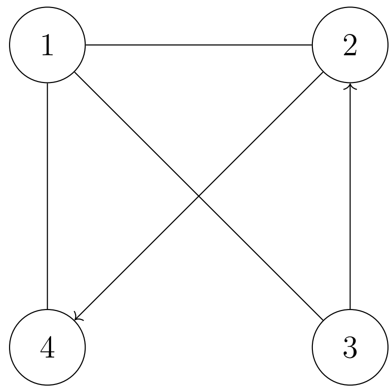
(a) **Reflexive and symmetric but not transitive**
Let R be a set where R = {(x,x), (y,y), (z,z), (x,y), (y,x), (y,z), (z,y)}
Reflexive: (x,x), (y,y), (z,z)
Symmetric: (x,y), (y,x), (y,z), (z,y) $\in$ R
Not transitive because (x,y), (y,z) $\in$ R while (x,z) $\notin$ R

(b) **Reflexive and transitive but not symmetric**
Let R be a set, R = {(x,x), (y,y), (z,z), (x,y), (y,z), (x,z)}
Reflexive: (x,x), (y,y), (z,z)
Transitive: (x,y), (y,z) $\in$ R and (x,z) $\in$ R
Not symmetric because (x,y) $\in$ R but (y,x) $\notin$ R

(c) **Symmetric and transitive but not reflexive**
Let R be a set, R = {(x,y), (y,x), (x,z), (z,x), (y,z), (z,y)}
Symmetric: (x,y), (y,x), (y,z), (z,y), (x,z), (z,x) $\in$ R
Transitive: (x,y), (y,z) $\in$ R and (x,z) $\in$ R
Not reflexive: (x,x), (y,y), (z,z) $\notin$ R

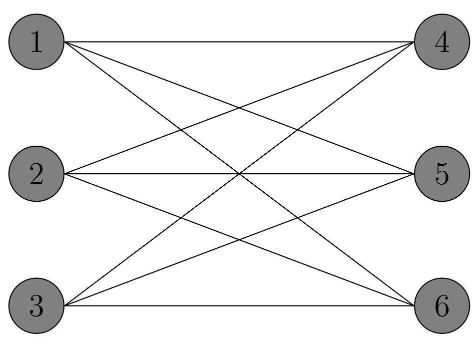
0.8 Consider the undirected graph G = (V,E) where V, the set of nodes, is {1, 2, 3, 4} and E, the set of edges, is {{1, 2}, {2, 3}, {1, 3}, {2, 4}, {1, 4}}. Draw the graph G. What are the degrees of each nodes? Indicate a path from node 3 to node 4 on your drawing of G.

(a) Graph G



(b) Degrees of node
Degrees of node 1: deg(1) = 3
Degrees of node 2: deg(2) = 3
Degrees of node 3: deg(3) = 2
Degrees of node 4: deg(4) = 2

0.9 Write a formal description of the following graph.



G = (V,E) for any order
G = {{1, 2, 3, 4, 5, 6},{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3,6)}