Homework #14

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Name Sec

Questions:	Answers:
1. Evaluate each of the following: a) $2^{\|A\|}$ where A = {a, b, c} b) 2^A where A = {a, b, c} c) 2^C where C = ∅ d) 2^D where D = {∅} e) $\|2^E\|$ where E = {∅, {∅}} f) $\|2^F\|$ where |F| = 10	
2. Let the universe U = {q, w, e, r, t, y, u, i, o, p} and let G = {q, w, r, t, y, u, i} and H = {w, r, y, i, p}. Give the bit string representation for the following expressions. In your representations, assume that the sequence for the elements is <q, w, e, r, t, y, u, i, o, p>. a) G b) H c) G ∩ H d) G ∪ H e) G – (~H) In addition, answer the following questions about the implementation. f) What is the big-Oh complexity of implementing set intersection if it is naïvely implemented by iterating over two unordered membership lists of different sizes (not using the bit-wise operators)? g) What is the big-Oh complexity of implementing set intersection if it is implemented using bit-wise operators?	

h) Under what conditions would the bit-wise operator implementation be worse than the naïve implementation?	
3. Consider the real numbers. a) For ordinary arithmetic, what issues (if any) arise because the reals are not closed under the set of operators {+, × ,<}? b) For ordinary arithmetic, what issues (if any) arise because the reals are not closed under the set of operations {+, −, × , ÷ }? c) For computer arithmetic, what two issues arise because the reals are not closed under the set of operators {+, × }?	
4. Given A ={a, b, c, d}, B ={1, 2, 3, 4, 5}, and C ={w, x, y, z}, let R:A↔B and S:B↔C be the relations R={(d, 1), (b, 2), (c, 3), (a, 4), (a, 3), (d, 2)} and S = {{2, z), (2, y), (4, w)}. Compute the following expressions. a) R˘ b) ~R c) (S˘)∘(R˘)	
5. Given the relations in problem #4 above, do the following. a) Give the matrix for R. b) Give the matrix for S. c) Using Boolean arithmetic, compute R× S. d) Which operation over R and S does R× S compute?	

6. Consider the following relations that are all relations on A (i.e. A ↔ A) where A = {a, b, c, d}. Indicate which properties each relation has by circling the property names the relation possesses. a) for {(a,a), (a,b), (d,c)} o Reflexive o Asymmetric o Irreflexive o Antisymmetric o Symmetric o Transitive b) for {(a,d), (d,a)} o Reflexive o Asymmetric o Irreflexive o Antisymetric o Symmetric o Transitive c) for {(a,d), (a,b), (c,c)} o Reflexive o Asymmetric o Irreflexive o Antisymetric o Symmetric o Transitive d) for {(a,b), (b,a), (d,d)} o Reflexive o Asymmetric o Irreflexive o Antisymetric o Symmetric o Transitive e) for {} o Reflexive o Asymmetric o Irreflexive o Antisymetric o Symmetric o Transitive f) for {(a,c), (c,a), (c,c), (a,a)} o Reflexive o Asymmetric o Irreflexive o Antisymetric o Symmetric o Transitive	
7. Consider the relation R = {(a, c), (a, d), (c, a), (d, b), (d, d)} over the set A = {a, b, c, d}. a) Give the matrix for R. b) Give the matrix for R^2. c) Does $R^2 \subseteq R$ hold? What can you thus	

conclude about whether R is transitive? d) How many violations of the definition of transitivity does R have? (Hint: Use R^2 as a guide for counting.)	