Test 2 review (Math 189 section 3 fall 2021)

Dr Holmes

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The test will be on Monday, November 1, in class. The Rules will be the same as for the first test: you may have a single sheet of notebook paper with whatever you like written on it (yes, on both sides!)

The test will cover sections we have had homework in in sections 3,4,6, and 13 up to and including Wednesday the 27th. Below, as for the first test, I indicate homework problems which represent things you should be able to do for a good performance on the test.

I am likely to make revisions in this document as homework comes in and as I think about writing the test. Ill keep a version date and time above.

There will be 8-10 questions on the test.

section 3.1: 3.1.1: understand the difference between membership $\in$ and subset $\subseteq$ (or $\subset$); 3.1.2 more of the same; 3.1.5 be able to produce set builder notation;

section 3.2: 3.2.1: more care in distinguishing between membership and subset. Notice that the empty set is a subset of every set but certainly not a member of every set; also $\emptyset$ is the empty set, not $\{\emptyset\}$; 3.2.2 write out a power set; 3.2.3 How large is a power set?; 3.2.4: be able to read set builder notation for a subset of a power set and if it is small write it out in list notation.

sections 3.3 and 3.4: 3.3: expect Venn diagram questions, like the ones on the handout. 3.3.1: given some sets be able to write out sets obtained by union and intersection (and also set difference) in roster notation (or say that they are infinite and you can't). 3.4.1 is a nice problem (and was one of the equations on the handout, I seem to remember). 3.4.3.

section 3.5: 3.5.2, also 3.5.4. You will have the table of set identities on your test, and also the propositional identities from section 1.5. But its a good idea to be familiar with them, not just looking them up. 3.5.3: be ready to generate a counterexample to a false equation.

section 3.6: 3.6.1, 3.6.2 very basic reading of definition. 3.6.6, 3.6.7 for trickier problems. Ill tell you if I expect string notation in a problem. 3.6.8 (hard, I know).

section 4.1: 4.1.1, 4.1.2: definition and arrow diagrams. Expect to look at diagrams and determine whether they are pictures of functions or not. I like 4.1.3 - 4.1.5. Being able to answer questions about domains and ranges of functions of various kinds is a useful skill.

section 4.2: Im not planning to ask a direct section 4.2 question, but the floor and ceiling functions may appear in other questions. You do need to understand them.

section 4.3: 4.3.1 (I might compare and contrast what happens if I change domain/target: for example, a is not onto if integers are used, but it is onto if all reals are used). 4.3.2: here is a place where floor and ceiling functions might be used. Determine whether given functions are one-to-one or not, onto or not, give reasons if they are, counterexamples if they are not. 4.3.6b (not a) (a proof question, Ill review on Friday). You should know the principles about relative sizes of the domain and target and the possibility of being one to one or onto.

section 4.4: 4.4.1: be able to recognize whether an arrow diagram represents a function with an inverse or not (and be able to say what the problem is if it is not). 4.4.2: be able to describe inverses of functions (or say why they don't have them), which I think Im likely give algebraically, though I am not allergic to string operations. 4.4.3: a is a proof problem of a kind you should expect to see; b is an inverse computation like any other, believe it or not. I'll review both on Friday.

section 4.5: Be able to compute compositions of functions presented via arrow diagrams, or say they dont exist, and say intelligent things about domains, targets, and ranges. Demonstrations that composition is not commutive are fun (4.5.1, 4.5.2, 4.5.5). For algebraic formulas, 4.5.8.

Be ready to draw arrow diagrams for compositions and also be ready to write them in roster notation as sets of ordered pairs.

Be able to compute compositions of functions presented as algebraic formulas.

section 4.6: I do not intend to ask about it.

section 6.1: Be familiar with ways to code binary relations. Sets of pairs, arrow diagrams, and matrices, and conversions between them, are all fair game. All the homework problems fall under this heading.

section 6.2: Be ready to use the words reflexive, anti-reflexive, symmetric, anti-symmetric, and transitive appropriately. 6.2.1, 6.2.4. 6.2.5 might be too abstract for test questions, but Ill go over it on Friday.

section 6.3: Be familiar with the definitions of various concepts. The definitions of trail, circuit, path and cycle (which are the same in 13.4) will be given on your paper. Be ready to interpret pictures and draw pictures. All problems are relevant.

section 13.1: All terminology in this section could be useful. The theorem about total degree being twice the number of edges is important. 13.1.1,3,4.

section 13.2-3: Be ready to think about when graphs might be "the same" (literally the same graph or the same in structure with a renaming of the vertices). Be ready to convert between representations of graphs as pairs (V,E) or as adjacency graphs or matrices. 13.2.1,2,3. 13.3.1,2. When graphs are isomorphic, be able to present the way to relabel one graph to get the other (the isomorphism); when graphs are not isomorphic, be ready to identify properties which show that they cannot be isomorphic without having to examine all the isomorphisms from one vertex set to the other.

section 13.4: The concepts of paths trails walks and cycles as in 6.3, but undirected. 13.4.1,2. Further I will ask a question about Eulerian walks (whose definition will be given on your paper): given two graphs, one with an Eulerian walk and one without, identify the one which has one and give the walk, and for the other give the reason that it cannot have an Eulerian walk.