

Math 190A, Fall 2022

Study guide for Midterm 2

- The exam is in-class on November 10.
- There are no notes or books allowed.
- I will provide paper, so do not bring a blue book.
- Content: everything in weeks 3–5. In my notes, §2.2–§3.3, except for last few results in §3.3

The format will be the same as the first midterm. Here is what I expect you to know:

- All homework problems from Homeworks 3 and 4 (ignore optional problems) whether they were graded or not. You might see them in the exact same form, either partially or in whole. You might also see them with slight modifications.
- Definitions: you may be asked to repeat definitions. You don't need to memorize the exact wording, but you do need to give something that has the exact same meaning. To make this simple for you and me, just stick with our definition and don't use results (for example, for “closed subset” our definition is “complement is open”; one could also say “contains all of its limit points” which is technically correct, but for us that is a result, and not the original definition). Here are the ones you could be asked:
 - (1) Metric and metric topology
 - (2) Hausdorff
 - (3) convergence of a sequence
 - (4) quotient topology
 - (5) connected (can use Definition 3.1.1, in which case include definition of separator, but can also use line below: only clopen subsets are \emptyset and X)
 - (6) path-connected (should include definition of path too, but you do not need to bring up the discussion of what domain you should use)
 - (7) connected component, path component
 - (8) locally (path-)connected (at x)
- Statements of propositions / theorems: you may be asked to state a formula or to complete or fully give the statement of a theorem. Again, the exact wording is not necessary, but the meaning should be exactly the same. Anything not mentioned here you still want to know because it might be useful to prove something else.
 - (1) Theorem 3.1.7: classification of connected subspaces of \mathbf{R}
 - (2) Intermediate value theorem: specifically, how to prove it using the previous results
- Proofs of propositions / theorems: you may be asked to reprove a proposition or theorem from class, either in part or in whole. Here are the ones you want to know:
 - (1) Lemma 2.2.4: open balls form a basis for metric topology
 - (2) Prop 2.2.13: sup metric topology is same as product topology
 - (3) Prop 2.3.3: metrizable implies Hausdorff
 - (4) Prop 2.3.5: product of Hausdorff is Hausdorff
 - (5) Prop 2.3.12: uniqueness of limits in Hausdorff space
 - (6) Prop 3.1.8: image of connected is connected
 - (7) Prop 3.1.17 (or some variant): union of connected subspaces is connected when intersection nonempty (or some weaker condition like in HW4 #1)
 - (8) Prop 3.1.19: finite product of connected spaces is connected
 - (9) Prop 3.2.2: path-connected implies connected
 - (10) Prop 3.2.3: image of path-connected is path-connected

- (11) Prop 3.2.10 (or some variant): conditions for union of path-connected subspaces to be path-connected
- (12) Prop 3.2.11: product of path-connected is path-connected
- New problem: there will be one problem that is not covered by the above, but expect it to be around the average difficulty of the homework problems you've seen.