Review for Midterm Exam

Topology, Math 441, Spring 2020

THE CITY UNIVERSITY OF NEW YORK College of Staten Island

- **Midterm will be held on Wednesday April 15th.** The midterm is divided into two parts - (1) An in-class multiple choice/short answer part held online during class time, and (2) a longer take-home part due by midnight on Wed April 15th posted right after class.
- **Syllabus for the midterm:** Topics covered from the text book from Chapters 1-5 (no path-connectedness).
  (note that there are topics from the book which we have not covered, those are not on the syllabus).
- The online part will have multiple choice, true or false, definitions, and examples type of questions.
- The take-home part will have problems like we have seen on the homework.
- The best way to prepare for the midterm is to go over the definitions, examples and theorems which we have studied in class.

---

1. **Know the definitions and examples of the following concepts**
   - Equivalence relation, Partition, cardinality, countable, uncountable sets, examples.
   - Metric space, open sets, continuous functions, examples.
   - Topological space, Basis, open sets, closed sets, comparing topologies, examples.
   - Many topologies we have studied - Discrete topology, Trivial topology, Metric topology, Co-finite topology, Particular point topology, Excluded point topology, Lower limit topology on $\mathbb{R}$ Standard topology on $\mathbb{R}^n$.
   - Continuous functions, Homeomorphism, examples.
   - Limit Points, Interior of a set, Closure of a set, Boundary of a set, Convergent sequence, examples.

- Topological properties: T_1, Hausdorff space, Separable second countable, examples.
- Continuity and convergent sequences.
- Subspace topology, Product topology, Quotient topology, examples.
- Connected spaces, connected subspaces, examples.

2. **Examples** You need to know examples for all the definitions above. Here are some examples.

   (a) Two topologies on a set X, one strictly finer than the other.

   (b) A topology on a set X and a basis for it.

   (c) A topological space and a subset which is both open and closed.

   (d) Finding closures, interiors and limit points of given subsets of topologial space.

   (e) Convergent Sequences.

   (f) Spaces which are Hausdorff and not Hausdorff.

   (g) Maps which are homeomorphisms and not homemorphisms.

   (h) Using continuity to show that sets are open or closed.

   (i) Spaces/subspaces which are Connected and disconnected.

   (j) Subspaces, product spaces and quotient spaces and their properties.

3. **Problems:**

   - See the problems on the homeworks.
   - Problems from textbook.
   - Problems from the book *Introduction to Topology: Pure and Applied* by Colin Adams and Robert Franzosa.