Math 521 Lecture 3: Homework 5
Fall 2004, Professor Ram
Due October 18, 2004

1 Favourites

An arsenal of examples in your head is crucial to processing mathematical concepts. For each of the following, list your favourite examples. Make sure your list includes enough examples to develop an understanding of the concept. If it is not clear that your example is an example then prove that it is.

1. topological spaces
2. open sets
3. closed sets
4. not open sets
5. not closed sets
6. continuous functions
7. compact sets
8. not compact sets
9. metric spaces
10. not metric spaces

2 Exercises

1. Define k-cells, balls and convex sets in $\mathbb{R}^k$ and show that balls are convex but that $k$cells are not.
2. HW: Show that the interior of E, E°, is the set of interior points of E.
3. Show that the closure of E, $\overline{E}$, is $E \cup E'$ where E' is the set of limit points of E.
4. Is Theorem 2.19 Baby Rudin true for every topological space? Explain.
5. Is Theorem 2.20 of Baby Rudin true for every topological space? What about the corollary? Explain.

6. Is Theorem 2.22 Baby Rudin true for every topological space? Explain.
7. Is Theorem 2.23 Baby Rudin true for every topological space? Explain.
8. Is Theorem 2.24 Baby Rudin true for every topological space? Explain.
9. Is Theorem 2.27 Baby Rudin true for every topological space? Explain.
10. Is Theorem 2.30 Baby Rudin true for every topological space? Explain.
11. Is Theorem 2.33 Baby Rudin true for every topological space? Explain.
12. Is Theorem 2.34 Baby Rudin true for every topological space? Explain.
13. Is Theorem 2.35 Baby Rudin true for every topological space? Explain.
14. Is Theorem 2.36 Baby Rudin true for every topological space? Explain.
15. Is Theorem 2.37 Baby Rudin true for every topological space? Explain.
16. Give an example of a collection of open sets whose intersection is not open.
17. Give an example of a collection of closed sets whose union is not closed.j
18. Let X be a set with the discrete topology. Show that every point is open.
19. Do Chapter 2, Problem 5 in baby Rudin.
20. Do Chapter 2, Problem 6 in baby Rudin.
21. Do Chapter 2, Problem 7 in baby Rudin.
22. Do Chapter 2, Problem 8 in baby Rudin.
23. Do Chapter 2, Problem 9 in baby Rudin.
24. Do Chapter 2, Problem 10 in baby Rudin.
25. Do Chapter 2, Problem 11 in baby Rudin.
26. Do Chapter 2, Problem 12 in baby Rudin.
27. Do Chapter 2, Problem 13 in baby Rudin.
28. Do Chapter 2, Problem 14 in baby Rudin.
29. Do Chapter 2, Problem 15 in baby Rudin.
30. Do Chapter 2, Problem 16 in baby Rudin.
31. Show that $[a, b]$ is uncountable.
32. Show that $\mathbb{R}$ is uncountable.
33. Show that the Cantor set is uncountable
34. Show that every perfect subset of $\mathbb{R}^k$ is uncountable.
35. Show that the Cantor set is perfect.
36. Do Chapter 2, Problem 17 in baby Rudin.
37. Do Chapter 2, Problem 18 in baby Rudin.

3 Vocabulary

Define the following terms.

1. open set
2. closed set
3. topology
4. topological space
5. discrete topology
6. neighborhood
7. limit point
8. interior point
9. interior
10. closure
11. compact set
12. perfect set
13. dense subset
14. metric space
15. continuous function
16. homeomorphism
17. subspace topology
18. metric space topology