**Math 3515 Midterm Outline**

1. Some simple true/false questions

Do any 6 of the following. Any additional problem counts as extra credit

1. Two set questions
2. Two countable question
3. Find lim inf and lim sup for the following sets
   1. Sequence or set 1
   2. Sequence or set 2
4. Another sequence question
5. Do the following series converge conditionally, absolutely, or diverge:
   1. Series 1
   2. Series 2
6. Another series question
7. Some concrete topology questions, like union or intersections of some sets
8. Another abstract topology question

**Analysis 1 – Midterm Sample Problems:**

1. True/false:

If converges, then at least one of and also converge.

If as , then and either both converge or both diverge

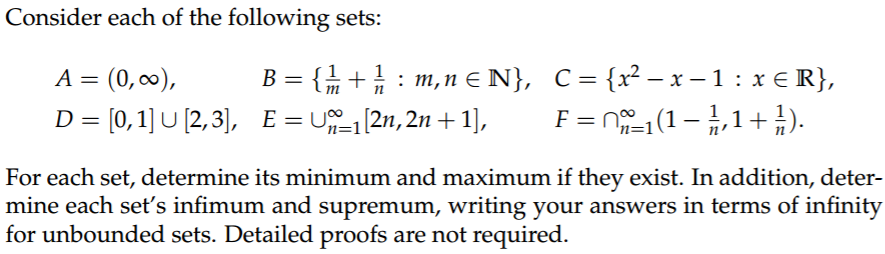
for any function

Let A, B be non-empty subsets of R, and define . Is ?

2. Prove that is A, B are countable, then A x B is countable

3. Prove that the set of all finite subsets of N is countable. Use that result to prove that the set of all infinite subsets of N must be uncountable.

4. Prove that the set of all subsequences of the sequence is uncountable

5.  
 For each set find its min and max, if they exist, and the sup and inf.

6. Let A be a set of real numbers with greatest lower bound l. Prove that for any there exists an such that

9. Compute and for:

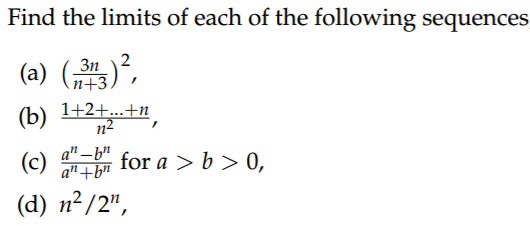
10. If is a sequence with then

11. What is ?

13. Find the following limits:

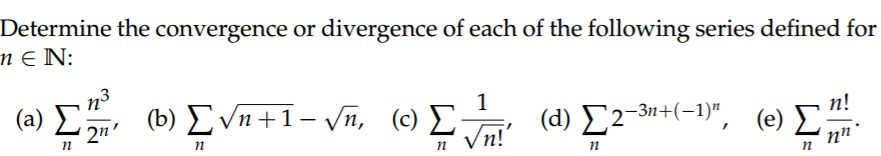
14. Let and . Show that converges and find the limit.

15. 

16.   
 (e)

18. Suppose the series and converge absolutely. Show that also converges.

19. Prove that converges and find the sum. Do the same for

20. 



21. Prove that 0.99999… = 1

22. If is compact and is closed, show that is compact. What about their union, i.e. is compact?

23. Prove that the union and intersection of two compact subsets of ***R*** are both compact. How about the *countable union* of compact sets? How about the *countable intersection* of compact sets, assuming it is not empty?

24. Prove that How about ?

25. Find the following unions or intersections:

26. Consider the set , i.e. the interval from 1 (excluded) to 3 (excluded), together with the point {4/1, 7/2, 10/3, 13/4, …}. Is it open or closed, or neither? Which points are interior points and boundary points? Which points are isolated and which ones are accumulation points?