1. Each question carries 5 points.

2. Precise and complete answers are a must for full credit. Show all your work. Calculators are NOT allowed.

1. State/ Define the following precisely.
   (i) Monotone sequence
   (ii) Injective function
   (iii) Complete ordered field
   (iv) Least Upper Bound
   (v) Countable set

2. Use the Archimedean property of $\mathbb{R}$ and prove that the set $\mathbb{N}$ of natural numbers is unbounded.

3. Prove that between any two real numbers there exists a rational number.

4. Prove that the set of irrational numbers is uncountable.

5. Suppose that $\{a_n\}$ and $\{b_n\}$ are sequences such that $\lim_{n \to \infty} b_n = 0$. If there exist constants $A$ and $k$ and a positive integer $n^*$ such that $|a_n - A| \leq k |b_n|$ for all $n \geq n^*$, prove that the sequence $\{a_n\}$ must converge to $A$.

The purpose of this practice test is only to let you know the pattern of the question paper. The actual questions and their difficulty level are not necessarily comparable to the questions given here in this practice test. To ensure good performance in the test, you must read the entire material taught in the class and be able to solve the homework problems. The purpose of examinations is to test your understanding of the concepts taught and your ability to put those concepts to logical use. Best of Luck.