Assignment 12

Due on 2021-04-14, 23:59 IST

Instructions to candidates

The data set for this assignment can be found in the course material. The data is available in a comma-separated values (CSV) file. You may use any programming language of your choice to complete the assignment.

1. (a) Let S be a subset of R^n. Define the closure of S, denoted by cl(S), as the smallest closed set containing S. Describe how you would compute the closure of a given set S.

(b) Let f: R^n → R^m be a continuous function. Define the set f(S) for a given set S ⊆ R^n. Formulate an algorithm to compute f(S) for a specific function f and set S.

2. (a) Consider a compact set S ⊆ R^n. Define the interior of S, denoted by int(S). Explain how you would determine the interior of a given set S.

(b) Let f: R^n → R be a continuous function. Define the set f(S) for a given set S ⊆ R^n. Formulate an algorithm to compute f(S) for a specific function f and set S.

3. (a) Let (X, d) be a metric space. Define the concept of a Cauchy sequence in X. Explain how you would determine if a given sequence is Cauchy.

(b) Let (X, d) be a metric space. Define the concept of a convergent sequence in X. Formulate an algorithm to determine if a given sequence converges and find its limit.

4. (a) Consider a bounded set S ⊆ R^n. Define the concept of a bounded set. Explain how you would determine if a given set S is bounded.

(b) Let f: R^n → R be a continuous function. Define the set f(S) for a given set S ⊆ R^n. Formulate an algorithm to compute f(S) for a specific function f and set S.

5. (a) Let (X, d) be a complete metric space. Define the concept of completeness. Explain how you would determine if a given metric space is complete.

(b) Let (X, d) be a metric space. Define the concept of a Cauchy sequence in X. Formulate an algorithm to determine if a given sequence is Cauchy.