

Name: _____ Score (Out of 6 points):

1. (3 points) For each of the following statements: if the statement is always true, write “True”. Otherwise, state a counterexample. **No further justification needed.**

Note: If the statement is not always true, you can receive partial credit for writing “False” without a counterexample.

- (a) Let A and B be nonempty subsets of a topological space (X, \mathcal{T}) . If A and B are connected and $A \cap B$ is nonempty, then $A \cup B$ is connected.
- (b) Let A and B be nonempty subsets of a topological space (X, \mathcal{T}) . If A and B are connected and $A \cap B$ is nonempty, then $A \cap B$ is connected.
- (c) Let A and B be nonempty subsets of a topological space. If $A \cap B = \emptyset$, then $A \cup B$ is disconnected.

2. (3 points) Let X be a topological space. Suppose that A is a nonempty proper subset of X such that $\partial A = \emptyset$. Show that X is disconnected.