**373 Math Problems-Chapter 2**

**From Text book:**

2.1: 1, 4, 5, 6, 7.

2.2: 1,2 , 4, 5, 6, 7, 8, 9.

**Additional Problems:**

1. List all topologies for a set containing three distinct elements.
2. Prove that for a non empty set X, the collection $τ=\left\{X,Φ\right\}∪\{U:X-U is countable\}$ is a topology on X, this topology is called co-countable topology.
3. Is there a set in which discrete and indiscrete topologies coincide on it?
4. Give an example of a nontrivial topology on an infinite set X which has only a finite number of elements.
5. If $τ\_{1} and τ\_{2} $are two topologies on X, is $τ\_{1}∩τ\_{2}$ a topology on X? Is $τ\_{1}∪τ\_{2}$ a topology on X?
6. Prove that $τ$ is the discrete topology on X iff every point in X is an open set.
7. Let $X=N$. For each $n\in N$ define $U\_{n}=\{n,n+1,n+2,…….\}$ .Let $τ=\left\{X,ϕ\right\}∪\{U\_{n}:n\in N\}$. Prove that $τ$ is a topology on X.

**From Text book:**

2.3:1, 2, 3, 4, 5, 6, 7, 8, 9, 13.

2.4: 1, 2, 3, 4, 5, 6, 7, 10, 13, 14, 15, 16, 17,

**Additional Problems:**

1. In $\left(R,U\right)$, do rationals form an open set? Closed set? Neither? Both? Justify your answer.
2. Consider $A=\left\{x:0<x<2\right\}∪\{10\}$. Find Cl(A) in $\left(R,U\right)$.
3. Give an example of a collection of open sets whose intersection is not open.
4. Give an example of two sets A and B of In $\left(R,U\right)$such that A and A\B are both open but B is not closed.
5. Give an example of a countable set in In $\left(R,U\right)$ that is not closed.
6. Give an example of a countable set in In $\left(R,U\right)$ that is closed.
7. Prove that $A is open iff A∩Bd\left(A\right)=∅$
8. Prove that $A is closed iff Bd\left(A\right)⊆A.$
9. Prove that $Bd\left(A\right)=∅ iff A is both open and closed.$

**From Text book:**

2.5:1,2,3,4,5,9.10.

**Additional Problems:**

1. Find a base for the open half-line topology which is different from the topology itself.
2. Let $(X,τ)$ be a topological space and $B$ a base for $τ$. Prove that $A⊆X$ is dense in X iff each nonempty element of $B$ contains a point of *A*.