1. The set of natural numbers $\mathbb{N}$ is of course an infinite set; for each of the following conditions on a collection partitioning $\mathbb{N}$, either find such a collection or explain why it cannot exist.

   (a) A collection $\mathcal{A}$ partitioning $\mathbb{N}$ such that $\mathcal{A}$ is a finite collection, and every element of $\mathcal{A}$ is a finite set.

   (b) A collection $\mathcal{B}$ partitioning $\mathbb{N}$ such that $\mathcal{B}$ is a finite collection, and every element of $\mathcal{B}$ is an infinite set.

   (c) A collection $\mathcal{C}$ partitioning $\mathbb{N}$ such that $\mathcal{C}$ is an infinite collection, and every element of $\mathcal{C}$ is a finite set.

   (d) A collection $\mathcal{D}$ partitioning $\mathbb{N}$ such that $\mathcal{D}$ is an infinite collection, and every element of $\mathcal{D}$ is an infinite set.

2. Answer the following questions about Cartesian products.

   (a) Explain why it is true that $A \times (B \cup C)$ is the same set as $(A \times B) \cup (A \times C)$. Don't simply appeal to authority; explain why every element of the first set should be an element of the second and vice versa.

   (b) Is $(A \cup B) \times (C \cup D)$ the same set as $(A \times C) \cup (B \times D)$? Why or why not?

 due January 28, 2016