1. Write out a careful proof that $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$. The problem will be graded on penmanship, clarity, and style of your solution.

2. Give an example showing that the square of the expected value of a random variable is not necessarily equal to the expected value of the variable squared.

3. Compare the Markov and Chebyshev bounds for the following probability distributions
   
   (a) $p(x) = \begin{cases} 1 & x = 1 \\ 0 & \text{otherwise} \end{cases}$
   
   (b) $p(x) = \begin{cases} 1/2 & 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$

4. (a) Consider a set of jars with marbles in them. As the number of jars increases to infinity we observe that the expected number of marbles per jar also goes to infinity. If we selected a jar at random what can we say about the probability that the jar will have at least one marble? Give a brief explanation for your answer.

   (b) If the expected number of marbles in a jar had gone to zero what could we have said about the probability that a jar selected at random would have at least one marble? Again given a brief explanation for your answer.

5. For a set of $n$ events what is the difference between the events being independent and the events being pairwise independent?