1. A parallel system of components functions when at least one of its components functions. Consider a parallel system of $m$ components and suppose each component independently functions with probability $1/3$. Find $P[\text{component 1 functions } | \text{ system is functioning}]$.

2. The lifetimes of batteries are independent uniformly distributed random variables over the interval $(0,1)$ month. A device requires 2 batteries to operate. When a battery fails, both batteries in service are replaced and discarded. If you have a total of $n$ batteries, find the mean of the total amount of time that the device can operate.

3. Consider a random variable $Y$ generated as follows. First select a value of $X = x$ at random (uniform) over the interval $(0,1)$. Then select a value of $Y = y$ at random (uniform) over the interval $(0, x)$. Find the probability density function $f_Y(y)$.

4. A virtual circuit spanning 6 nodes has 12 outstanding packets. Let $k_i$, $i = 1, 2, 3, 4, 5, 6$ denote the number of these packets at node $i$, and let the state of the virtual circuit be represented by the vector $(k_1, k_2, k_3, k_4, k_5, k_6)$. Suppose it is known that a total of three nodes contain zero packets. How many possible states are there?