Suppose n balls are distributed at random into r boxes. Let X_i be defined by

$$X_i = \begin{cases} 1 & \text{if box } i \text{ is empty,} \\ 0 & \text{otherwise.} \end{cases}$$

1. (a) Find $E(X_i)$.

$$E(X_i) = \rule{5cm}{0.4pt}$$

(b) For $i \neq j$, find $E(X_i X_j)$.

$$E(X_i X_j) = \rule{5cm}{0.4pt}$$

2. Let S denote the number of empty boxes. Find $E(S)$. (Hint: $S_r = X_1 + X_2 + \cdots + X_r$)

$$E(S_r) = \rule{5cm}{0.4pt}$$