Question 3

(a)

Given: $P(\text{one engine failing}) = 0.01$

To Find: $P(\text{both engines failing})$

Solution:

Since the two engines operate independently, we have

$$P(A \wedge B) = P(A)P(B)$$

$$P(\text{both engines failing}) = P(\text{one engine failing})^2$$

$$P(\text{both engines failing}) = 0.01^2$$

$$P(\text{both engines failing}) = 0.0001 = 0.01\%$$

$\therefore 0.01\%$ is the chance that the plane will fail to complete a four-hour flight to Oklohoma due to engine failure.

(b)

To Find: $P(\text{atlest 2 people having same birthday in 30 people})$

Solution:

We know that

$$P(\text{atleast 2 people having same birthday}) = 1 - P(\text{everyone has unique birthday})$$

Now, to find the probability of 30 people having unique birthdays, we need to choose 30 unique days from 365 days

$$P(\text{everyone has unique birthday}) = \frac{\binom{365}{30}}{365^{30}}$$

$$P(\text{everyone has unique birthday}) = 0.2936837572807312$$

$$P(\text{atleast 2 people having same birthday}) = 1 - 0.2936837572807312$$

$$P(\text{atleast 2 people having same birthday}) = 0.7063162427192688$$

$\therefore 70.6\%$ is the probability that atleast two people have the same birthday in a room of 30 people.