1. [1.5 pts each] Let $E$ be the event that you draw a queen from a regular deck, and let $F$ be the event that you draw a spade from a regular deck. Find

(a) $p(E) = \frac{4}{52} \quad [4 \text{ queens in the deck}]$

(b) $p(E \cap F) = \frac{1}{52} \quad [1 \text{ queen of spade in the deck}]$

(c) $p(E \mid F) = \frac{p(E \cap F)}{p(F)} = \frac{1/52}{13/52} = \frac{1}{13}$

(d) $p(F \mid E) = \frac{p(E \cap F)}{p(E)} = \frac{1/52}{4/52} = \frac{1}{4}$

(e) $p(E \cup F) = p(E) + p(F) - p(E \cap F) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52}$

(f) $p(E') = 1 - p(E) = 1 - \frac{4}{52} = \frac{48}{52}$

2. [3 pts each] A box contains 25 fruits, 6 of them oranges, the rest are apples. You randomly grab 4 of them.

(a) How many different ways can he choose exactly 3 oranges?

\[C(6,3) \cdot C(19,1)\]

(b) How many different ways can he choose at least 3 oranges?

\[C(6,3) \cdot C(19,1) + C(6,4) \cdot C(19,0) \quad \text{[break it into exactly statements]}\]
3.  [2pts each] Draw two marbles from a box that contains 6 blue and 5 white marbles without replacement. Let $E =$ drawing a blue marble first and $F =$ drawing a white marble second. Find

(a)  [3pts] $p(E) = \frac{6}{11}$

(b)  [3pts] $p(F \mid E) = \frac{5}{10}$ [one blue marble is gone]

(c)  [3pts] $p(E \cap F) = \frac{6}{11} \cdot \frac{5}{10}$

(d)  [3pts] $p($you draw one blue and one white marble$) = p($first blue and second white or first white and second blue$) =$

$$\frac{6}{11} \cdot \frac{5}{10} + \frac{5}{11} \cdot \frac{6}{10} = 2 \cdot \frac{6}{11} \cdot \frac{5}{10}$$