Problem 1

1. The set of all possible arrangements of a deck of 52 cards.

   Each arrangement has a probability $P = \frac{1}{52!} = 1.240 * 10^{-68}$

2. a) Let a be the event where the first two cards include at least one ace.

   $$P(a) = 1 - \frac{48\,nCr\,2}{52\,nCr\,2} = \frac{33}{221} = 0.154$$

   b) Let b be the event where the first five cards include at least one ace.

   $$P(b) = 1 - \frac{48\,nCr\,5}{52\,nCr\,5} = \frac{18472}{54145} = 0.341$$

   c) Let c be the event where the first two cards are a pair of the same rank.

   $$P(c) = \frac{13\,nCr\,1 \cdot 4\,nCr\,2}{52\,nCr\,2} = \frac{1}{17} = 0.059$$

   d) Let d be the event where the first five cards are all diamonds.

   $$P(d) = \frac{13\,nCr\,5}{52\,nCr\,5} = \frac{33}{66640} = 4.952 * 10^{-4}$$

   e) Let e be the event where the first five cards form a full house.

   $$P(e) = \frac{13\,nCr\,1 \cdot 4\,nCr\,3 \cdot 12\,nCr\,1 \cdot 4\,nCr\,2}{52\,nCr\,5} = \frac{6}{4165} = 0.001$$