1- (12 choose 4,4,4) = 12! / (4!4!4!) = 27,720

2-

```
          a
         / \
        b   c
       / \ / \
      a   c   b
     / \ / \ / \
    b   a   c   a
    |   |   |   |
    c   c   b   b
```

3- (i)

The total number of ways to choose 2 items from 12 is:
12 choose 2 = 12! / (2!10!) = 66
The number of ways to choose 2 defective items from 4 is:
4 choose 2 = 4! / (2!2!) = 6
So, P(A) = 6/66 = 1/11
The number of ways to choose 2 non-defective items from 8 (12-4) is:
8 choose 2 = 8! / (2!6!) = 28
So, P(B) = 28/66 = 14/33

(ii)

the probability that both items are non-defective is 28/66 = 14/33.
the probability that at least one item is defective is:
1 - 14/33 = 19/33

4- (i)

The total number of ways to choose 3 items from 15 is:
15 choose 3 = 15! / (3!12!) = 455
The number of ways to choose 3 non-defective items from the 10 (15-5) non-defective items is:
10 choose 3 = 10! / (3!7!) = 120
So, the probability that none of the three selected items is defective is:
120/455 = 24/91

(ii)

3 x 10 x 9 = 270
the probability of choosing exactly one defective item is:

270/455 = 54/91
(iii)
The number of ways to choose 3 non-defective items from the 10 (15-5) non-defective items is:
10 choose 3 = 10! / (3!7!) = 120
So, the probability that none of the three items is defective is:
120/455 = 24/91
Therefore, the probability that at least one item of the three items is defective is:
1 - 24/91 = 67/91

5-
P(A U B) =p(A) + p(B) – p(A ∩ B)
= 10/30 + 15/30 + 5/30 = 20/30

6-
P(Ac) = 1 - 3/8 = 5/8

P(Bc) = 1 - 1/2 = ½

P(A union B) = 3/8 + 1/2 - 1/2 = 3/8
Then ; P(Ac intersection Bc) = 1 - P(A union B) = 1 - 3/8 = 5/8

(A intersection B) = 1/2, so (A intersection B)c = 1 - 1/2 = 1/2.

P(A intersection Bc) = P(Bc) - P((A intersection B)c)
We know that P(Bc) = 1/2 and (A intersection B)c = 1/2, so:
P(A intersection Bc) = 1/2 - 1/2 = 0

P(B intersection Ac) = P(B) - P((A intersection B)c)
We know that P(B) = 1/2 and (A intersection B)c = 1/2, so:
P(B intersection Ac) = 1/2 - 1/2 = 0

7-
P(at least one 7) = 1 - P(no 7's in three rolls)
= 1 - (30/36)^3
= 1 - 0.5787

= 0.4213

The probability is 0.4213 or 42.13%.

8-

$\Sigma P(x) = 1$

$k^2 - 8 = 1$

$k^2 = 9$

$k = \pm 3$

9-

$P(A' \cap B') = P((A \cup B)')$

$P(A \cup B) = 0.35 + 0.45 = 0.8$

$P(A' \cap B') = P((A \cup B)') = 1 - P(A \cup B) = 1 - 0.8 = 0.2$