Hypergeometric Distribution

Suppose we randomly select 5 cards without replacement from an ordinary deck of playing cards. What is the probability of getting exactly 2 red cards? N = 52; since there are 52 cards in a deck. k = 26; since there are 26 red cards in a deck. n = 5; since we randomly select 5 cards from the deck. x = 2; since 2 of the cards we select are red.

In [34]:

```
from scipy.stats import hypergeom


N = 52                          # Total number of cards

n = 5                           # Total number of cards randomly selected

k = 26                          # Since there are 26 red cards

x = 2                           # Since we want to compute the probability of two red cards

prob = round(hypergeom.pmf(x, N, n, k), 4)      # Compute probabilites corresponding to
random variable x

print('Probability is :', prob)
```

```
Probability is : 0.3251
```

Example Suppose that a shipment contains 5 defective items and 10 non defective items. If 7 items are selected at random without replacement, what is the probability distribution of defective items?

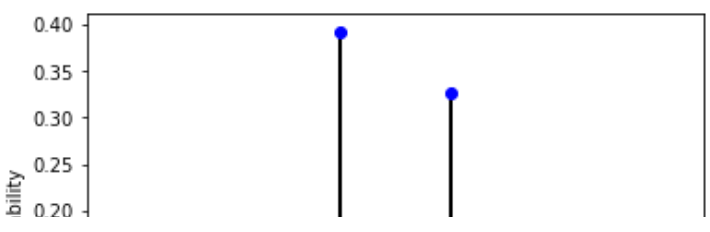
h(x; N, n, k) = (kCx) x (N–kCn–x) /NCn , max{0, n-(N-k)} ≤ x ≤ min{n, k}

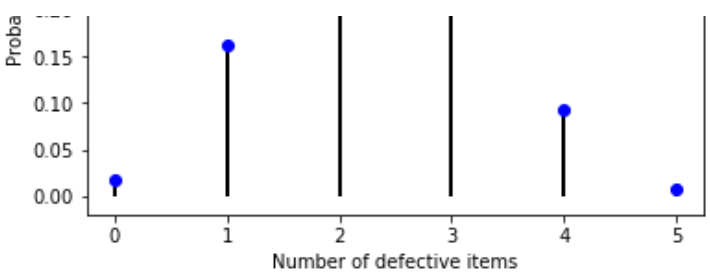
In [31]:

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import hypergeom

[N, n, k] = [15, 7, 5]
lLimit = max(0, n-(N-k))
print('lLimit: ', lLimit)
uLimit = min(n, k)
print('uLimit: ', uLimit)
rv = hypergeom(N, n, k)
x = np.arange(lLimit, uLimit + 1)
probability = rv.pmf(x)
print('Sum of Probability is:  ', sum(probability))
fig = plt.figure()
ax = fig.add_subplot(111)
ax.plot(x, probability, 'bo')
ax.vlines(x, 0, probability, lw = 2)
ax.set_xlabel('Number of defective items')
ax.set_ylabel('Probability')
plt.show()
```

```
lLimit:  0
uLimit:  5
Sum of Probability is:   1.0
```





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