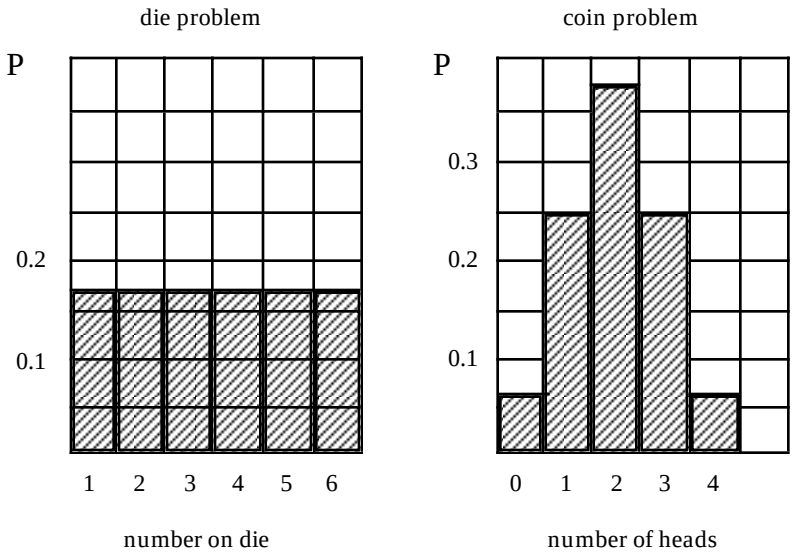
Probability Distributions 30

In general, it is more useful to look at probability distributions, rather than frequency distributions.

In the last worksheet, we looked at two frequency distributions. In the first example, we rolled a die in order to observe which number turned up. In the second example, four coins were flipped to observe the number of heads shown.

The probability distributions for the two experiments are shown below.



In the first example, the probability of any number showing in a roll of the die is 1/6 = 0.17. This distribution is flat. The mean and standard deviation in this case, do not tell us anything. Note that the sum of the probabilities is 1. Or, the area under the curve is equal to 1.

In the second example, we can calculate the probability of tossing 0-4 heads when 4 coins are tossed. The probabilities are found using the binomial distribution formula. P(x heads) = ${}_nC_x\ p^x\ q^{n-x}$. In this case p = success = 1/2, q = failure = 1/2, and n = 4. The probabilities of tossing no head, 1, 2, 3, or 4 heads, are found to be; 1/16, 4/16, 6/16, 4/16, and 1/16 respectively. This is shown in the diagram above which is called a binomial distribution. The sum of the probabilities = the area under the curve = 1.

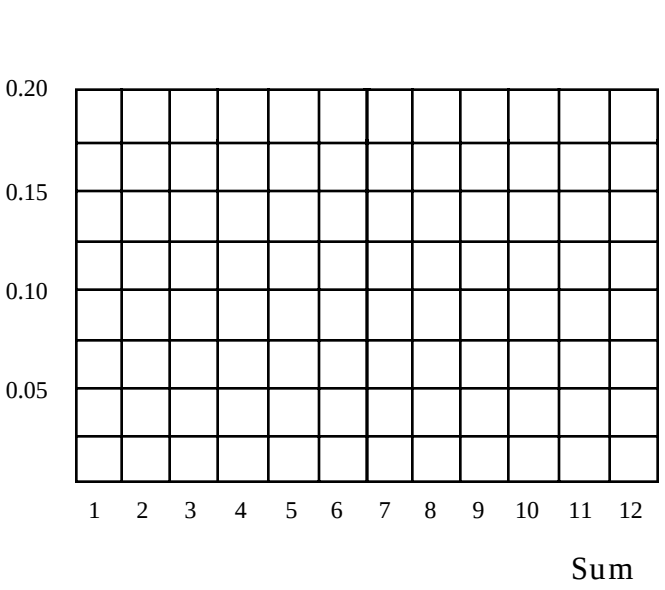
For the binomial distribution, it can be shown that:

$$\bar{x} = n \cdot p$$

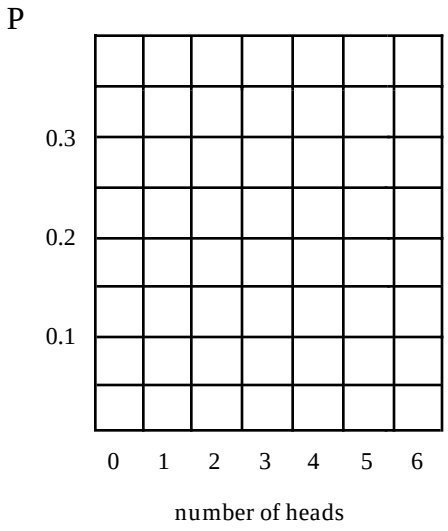
$$\sigma = \sqrt{n \cdot p \cdot q}$$

Problems:

1) Sketch the probability distribution for the sum shown on a pair of dice. (note: this is **not** a binomial distribution).

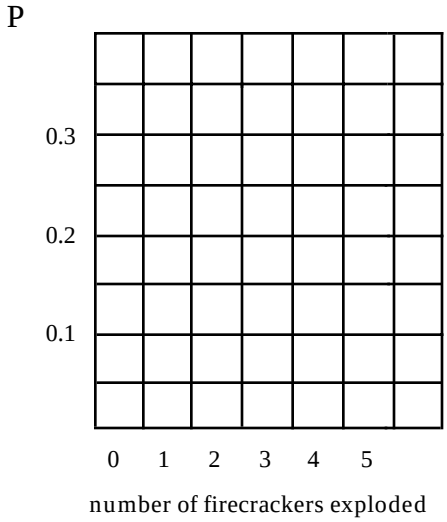


2)a) Sketch the binomial distribution for the number of heads, if six coins are tossed.



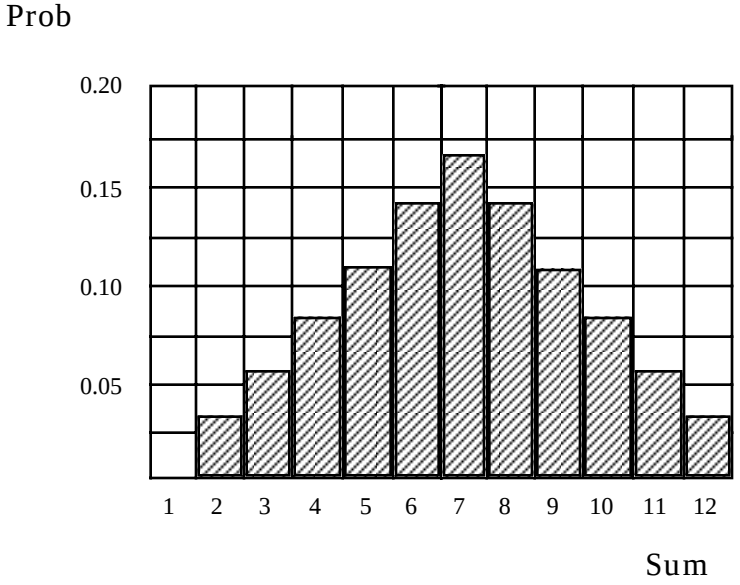
b) Find the mean and standard deviation (to one decimal) for this distribution.

3) The probability that a firecracker explodes is 0.65. Sketch the binomial distribution for the number of firecrackers which will explode in a group of five firecrackers.

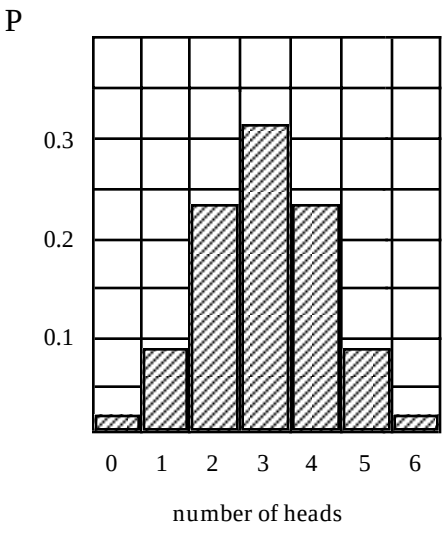


Answers:

1)

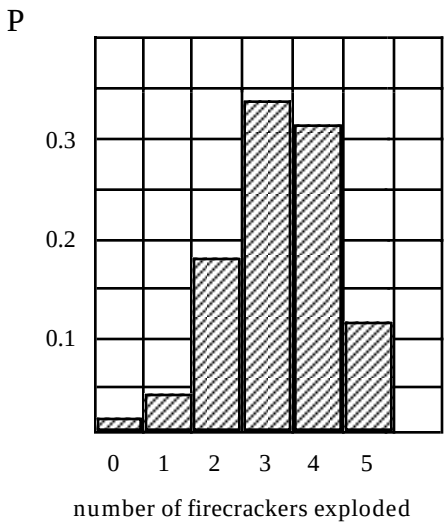


2)a)



b) mean = 3.0, standard deviation = 1.2.

3)a) P(0) = 0.005, P(1) = 0.049, P(2) = 0.181, P(3) = 0.336, P(4) = 0.312, P(5) = 0.116.


P
0.3
0.2
0.1
0 1 2 3 4 5
number of firecrackers exploded