Analysis discrete distributions

The multinomial distribution

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If there are more than two possible states we can use a multinomial distribution. In this distribution we can define the total population as N and the number of objects in each state as n_1, n_2 etc. For example, for N dice we have

$$F = \frac{N!}{n_1!\, n_2!\, n_3!\, n_4!\, n_5!\, n_6!}$$

If we take the game Yahtzee that we play with 5 dice N = 5. Then if we cast the dice and we obtain 2 dice with 1 and 3 dice showing 2, we have a full house. In this case:

$$F = \frac{5!}{2!\, 3!\, 0!\, 0!\, 0!\, 0!}$$

Thus, F = 10. The combinatoric in this case is $C = 6^5 = 7776$. Thus, P = F/C = 10/7776 = 0.001. There are actually 12 Full houses so the total probability of obtaining a full house is around 1%. We can apply this same reasoning to any cast of the dice.