Probability of a Flush

Computational Economics - MGSC 532

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Here is the calculation of the probability of a flush in the game of poker:

$$P(everyflush) = \frac{\binom{13}{5}\binom{4}{1}}{\binom{52}{5}} = \frac{\frac{13!}{5!(13-5)!} \times \frac{4!}{1!(4-1)!}}{\frac{52!}{5!(52-5)!}} = \frac{1287 \times 4}{2598960} = 0.00198 \tag{1}$$

$$P(straightflush) = \frac{\binom{9}{1}\binom{4}{1}}{\binom{52}{5}} = \frac{\frac{9!}{1!(9-1)!} \times \frac{4!}{1!(4-1)!}}{\frac{52!}{5!(52-5)!}} = \frac{9 \times 4}{2598960} = 1.385e^{-5} \tag{2}$$

$$P(royalflush) = \frac{\binom{4}{1}}{\binom{52}{5}} = \frac{\frac{4!}{1!(4-1)!}}{\frac{52!}{5!(52-5)!}} = \frac{4}{2598960} = 1.539e^{-6} \tag{3}$$

$$P(flush) = P(everyflush) - P(straightflush) - P(royalflush) \tag{4}$$

$$P(flush) = 0.00198 - 1.385e^{-5} - 1.539e^{-6} = 0.001964611 \tag{5}$$

The probability of a flush in a hand of poker is about 0.196%.