Assignment 1

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1 PROBLEM

(ProbMan 1.9) In an examination, 20 questions of true-false type are asked. Suppose a student tosses a fair coin to determine his answer to each question. If the coin falls heads, he answers 'true'; if it falls tails, he answers 'false'.

Find the probability that he answers at least 12 questions correctly.

2 SOLUTION

The probabilty of solving each question is $\frac{1}{2}$

Let E_r be the event where exactly r questions are correct.

$$\therefore Pr(E_r) = \frac{{}^nC_r}{2^{20}} \tag{2.0.1}$$

Obviously, all E_i are mutually exclusive (where i $\in$\{0,1,2,...,20\}).

Let us represent the Event of getting 12 or more questions correct by $E_{\geq 12}$

So,

$$Pr(E_{\geq 12}) = \sum_{r=12}^{20} Pr(E_r) \tag{2.0.2}$$

$$= \sum_{r=12}^{20} \frac{{}^nCr}{2^{20}} \tag{2.0.3}$$

$$= \frac{\sum_{r=12}^{20} {}^nCr}{2^{20}} \tag{2.0.4}$$

$$= \frac{263950}{2^{20}} \tag{2.0.5}$$

$$= 0.25172233581 \tag{2.0.6}$$

By simulations, we can see that the theoretical value is close to the experimental value.