Question 12.13.3.86
Probability and Random Processes

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The probability that a person is not a swimmer is 0.3. The probability that out of 5 persons 4 are swimmers is

1) ${}^5C_4\,(0.7)^4\,(0.3)$
2) ${}^5C_1\,(0.7)\,(0.3)^4$
3) ${}^5C_4\,(0.7)\,(0.3)^4$
4) $(0.7)^4\,(0.3)$

Solution: Let,X_i denote the sequence of independent bernoulli random variables

$$X_i = \begin{cases} 1, & \text{if person is swimmer} \\ 0, & \text{otherwise} \end{cases} \tag{1}$$

which means

$$p_X(k) = \begin{cases} 0.7 = p, & k = 1 \\ 0.3 = q, & k = 0 \end{cases} \tag{2}$$

and Y be summation of all such sequences

$$Y = \sum_{i=0}^{n} X_i \tag{3}$$

The pmf of having k swimmers out of n swimmers is given by:

$$p_Y(k) = {}^nC_k p^k q^{n-k} \tag{4}$$

$$= {}^nC_k\,(0.7)^k\,(0.3)^{n-k} \tag{5}$$

for $n = 5$ and $k = 4$:

$$p_Y(4) = {}^5C_4\,(0.7)^4\,(0.3) \tag{6}$$