1. (2 points) Do a $\chi^2$-test of a random number generator you work with by generating a large number of random numbers from a uniform distribution over \{1,2,...,10\} and then comparing the actual number of occurrences of each event with the expected number.

2. (2 points) The probability of error in transmitting a bit over a communications channel is $10^{-4}$, and errors are independent. What is the probability of more than $k$ errors, $0 \leq k \leq 3$, in transmitting a block of 1,000 bits? Note that there are four different answers.

3. (2 points) Assume that the number of chocolate chips in cookies is Poisson distributed. What is the expected number of chips per cookie if 1% of the cookies have no chips?

(Extra Credit: If you do an empirical study, then...)

4. (3 points) Consider a computer system with a Poisson job arrival stream with an average arrival rate of 60 jobs/hour. Determine the probability that the time interval between successive job arrivals is:

   A) Longer than four minutes.
   B) Shorter than eight minutes.
2. There are \( n = 1,000 \) trials, and the probability of an error is \( q = 10^{-4} \). Since the errors are independent, then the number of errors will be binomially distributed. Let r.v. \( X \) denote the number of errors.

\[
\Pr\{X > K\} = 1 - \Pr\{X \leq K\} = 1 - \sum_{0 \leq k \leq K} \binom{n}{k} q^k (1-q)^{n-k}
\]

<table>
<thead>
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<th>( K )</th>
<th>( \Pr{X &gt; K} )</th>
</tr>
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<tr>
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<tr>
<td>3</td>
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</table>

3. If \( X \) is a r.v. denoting chocolate chips per cookie, then

\[
\Pr\{X = 0\} = .01 = e^{-l}(l^0/0!) = e^{-l}, \text{ so } e^{-l} = 100 \text{ and }
\]

\[
l = \ln(100) = 4.605170185988092
\]

4. \( l = 60 \text{ jobs/hour} = 1 \text{ job/minute} \). Letting r.v. \( X \) denote the number of arrivals in a given time interval,

A) \( \Pr\{X = 0 \text{ for } t = 4\} = e^{-4\times4^0/0!} = e^{-4} = 0.018315638888734182 \)

B) \( \Pr\{X > 0 \text{ for } t = 8\} = 1 - \Pr\{X = 0 \text{ for } t = 8\} = 1 - e^{-8\times8^0/0!} = 1 - e^{-8} = 0.9996645373720975 \)