1. In a noisy communication channel, there is a 2% chance that each transmitted bit (0 or 1) will be corrupted. If a message of 1000 bits is transmitted, what is the approximate probability that:

(a) \textbf{(7 points)} no more than 10 bits will be corrupted?

(b) \textbf{(9 points)} exactly 30 bits will be corrupted?
2. Assume that the time (in hours) it takes to repair an electrical breakdown, is a continuous random variable $X$ with probability density function,

$$f(x) = \begin{cases} \frac{1}{1}, & \text{if } 0 < x < 1 \\ 0, & \text{otherwise.} \end{cases}$$

(a) (4 points) Find the expected repair time, in minutes.

(b) (8 points) Find the standard deviation of the repair time, rounded to the nearest minute.

(c) (7 points) If the cost incurred in a repair which takes $X$ (hours) is $10X^3 + 40$ dollars ($), find the expected repair cost.

3. (a) & (b) The number of fish caught by a fisherman is Poisson distributed with mean two per hour. Suppose, he starts fishing at 10 a.m., find the probability that the number of fish caught by him is:

(a) (8 points) at least one, by 10:30 a.m.,
3. (b) **(6 points)** exactly four, by noon.

4. The time it takes a bank clerk to process a check deposit has an exponential distribution with mean 50 seconds.
   (a) **(8 points)** Compute the probability that a check deposit takes less than 40 seconds.
   
   (b) **(8 points)** What is the median of this distribution?

5. (a) & (b) The mean GPA of engineering majors at a large university is 3.23, with a standard deviation of 0.72. Assume that any class of students represents a random sample from this university. In a class of 49 students, find the probability that the average GPA is:
   
   (a) **(8 points)** between 3.2 and 3.25,
6. A researcher is interested in estimating the true average bonding strength (measured in suitable units) of a certain brand of an adhesive applied to two particular types of surfaces.

(a) **(10 points)** What sample size is necessary in order for the sample mean bonding strength to be within 5 of the true mean, with 99% confidence? The population standard deviation of the bonding strength is known to be 30.

(b) **(10 points)** Two hundred values of these bonding strengths resulted in a sample mean and standard deviation of 261.8 and 29.44, respectively. Calculate the 98% confidence interval for the true mean bonding strength.