

Homework Assignment- Extra credit

Due May 5th before midnight via Canvas

SDS 321 Intro to Probability and Statistics

1 Questions

- (4 pts) Civil engineers believe that W , the amount of weight (in units of 1000 pounds) that a certain span of a bridge can withstand without structural damage resulting, is normally distributed with mean 400 and standard deviation 40. Suppose that the weight (again, in units of 1000 pounds) of a car is a random variable with mean 4 and standard deviation .5. Approximately how many cars would have to be on the bridge span for the probability of structural damage to exceed .05?
- (4 pts) An insurance company has 10,000 automobile policyholders. The expected yearly claim per policyholder is \$250, with a standard deviation of \$750. Approximate the probability that the total yearly claim exceeds \$2.5 million.
- (4 pts) Fifty numbers are rounded off to the nearest integer and then summed. If the individual roundoff errors are uniformly distributed over $[-.5, .5]$, approximate the probability that the resultant sum differs from the exact sum by more than 3.
- (4 pts) A certain component is critical to the operation of an electrical system and must be replaced immediately upon failure. If the mean lifetime of this type of component is 100 hours and its standard deviation is 30 hours, how many of these components must be in stock so that the probability that the system is in continual operation for the next 2000 hours is at least .95?
- (8 pts) Read about convolution of two i.i.d random variables from B/T 4.2. You can also find more information here: https://www.dartmouth.edu/~chance/teaching_aids/books_articles/probability_book/Chapter7.pdf Briefly, if $Z = X + Y$, then for discrete X, Y we have $P(Z = z) = \sum_y P(X = z - y)P(Y = y)$. For continuous X, Y , we replace the sum by integral and PMF's by respective PDFs. $f_Z(z) = \int_{-\infty}^{\infty} f_X(z - y)f_Y(y)dy$.
 - If $X \sim Exponential(2)$ and $Y \sim Exponential(2)$ then find the PDF of $Z = X + Y$ when X and Y are independent.
 - If $X \sim Uniform([0, 2])$ and $Y \sim Uniform([0, 2])$, then find the PDF of $Z = X + Y$ when X and Y are independent. *Hint: almost identical problems to both are worked out in the above source.*