**Topics: Normal distribution, Functions of Random Variables**

1. The time required for servicing transmissions is normally distributed with *μ* = 45 minutes and *σ* = 8 minutes. The service manager plans to have work begin on the transmission of a customer’s car 10 minutes after the car is dropped off and the customer is told that the car will be ready within 1 hour from drop-off. What is the probability that the service manager cannot meet his commitment?
2. 0.3875
3. 0.2676
4. 0.5
5. 0.6987
   * + - * # mean = 45, S.D. = 8 , x=50

from scipy.stats import norm

1-norm.cdf(50,loc = 45,scale = 8)

0.26598552904870054

1. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean *μ* = 38 and Standard deviation *σ* =6. For each statement below, please specify True/False. If false, briefly explain why.
2. More employees at the processing center are older than 44 than between 38 and 44.
   * + - * False , If more employees are older than 44, this will shift the µ and sd. Which is not possible as µ is given 38 with sd 6.
         * 68% of data falls within one standard deviation of the mean

µ+1σ = 38+6 = 44

1. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.
   * + - * True,

#Q2) mean = 38, S.D. = 6 , x=400

norm.cdf(30 ,loc = 38,scale = 6) , 0.09121\*400

(0.09121121972586788, 36.484)

1. If *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) are *iid* normal random variables, then what is the difference between 2 *X*1 and *X*1 + *X*2? Discuss both their distributions and parameters.
   * + X1+X2 are two sample independent normal distribution and 2X1 will just scale the normal distribution by 2 times.
2. Let X ~ N(100, 202). Find two values, *a* and *b*, symmetric about the mean, such that the probability of the random variable taking a value between them is 0.99.
3. 90.5, 105.9
4. 80.2, 119.8
5. 22, 78
6. 48.5, 151.5
7. 90.1, 109.9
   * + - * p(a<x<b) = 0.99

Z value at 0.5th percentile is given as

                     Z(0.5) = stats.norm.ppf(0.005)= -2.576

Z value at 99.5 percentile is given as

                         Z(99.5) = stats.norm.ppf(0.995) = 2.576

Z = (x - 100)/20 = > x = 20z+100

      a = -(20\*2.576) + 100= 48.5

      b = (20\*2.576)+100= 151.5

OR

* + - * + #Q4) mean = 100, S.D. = 20 , x= ? , z=0.995

norm.ppf(0.995 ,loc = 100 ,scale = 20), norm.ppf(0.005 ,loc = 100 ,scale = 20)

(151.516586070978, 48.483413929021985)

1. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions Profit1 ~ N(5, 32) and Profit2 ~ N(7, 42) respectively. Both the profits are in $ Million. Answer the following questions about the total profit of the company in Rupees. Assume that $1 = Rs. 45
2. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
   * + - norm.interval(0.975 ,loc = 45\*5 ,scale = 3)

(218.27579181718517, 231.72420818281483),

* + - * norm.interval(0.975 ,loc = 45\*7 ,scale = 4)

(306.0343890895802, 323.9656109104198))

the annual profit range of the company is between (524 ,554)

1. Specify the 5th percentile of profit (in Rupees) for the company
   * + - norm.ppf(0.05 ,loc = 45\*5 ,scale = 3)

(220.0654391191456)

* + - * norm.ppf(0.05 ,loc = 45\*7 ,scale = 4)

(308.4205854921941)

1. Which of the two divisions has a larger probability of making a loss in a given year?

* + - * + 2nd division N(7, 42) has larger probability of making a loss in a given year because of high variance compare to another one.