**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

Ans: (1-stats.norm.cdf(60,55,8))

0.26598552904870054~0.2676

Option B

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.

Ans:true

stats.norm.cdf(44,38,6)

For 44 age persons the has 84%

Stats.norm.cdf(38,38,6)

For 38 age persons has 50%

So more number of employess lies between 44 and 38

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

Ans:True

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.

2X1=2N(μ, σ2)= N(2μ,4 σ2)

X1+X2=N(μ, σ2)+ N(μ, σ2)=(2μ,2 σ2)

They are differ by standard deviation not by the mean

1. 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.
2. 90.5, 105.9
3. 80.2, 119.8
4. 22, 78
5. 48.5, 151.5
6. 90.1, 109.9

Ans: stats.norm.interval(0.99,100,20)

(48.48341392902199, 151.516586070978)

Option D

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.

Company profit is (5+7,(3+4) 2)=12,5

Where mean=5+7=12

12\*45=540(in rupees)

Std=sqrt(sq.3+sq.4)=sqrt.(9+16)=5

5\*45=225(in rupees)

stats.norm.interval(0.95,540,225)

(99.00810347848784, 980.9918965215122)

1. Specify the 5th percentile of profit (in Rupees) for the company

Here we use z test formula is x-z\* σ/sqrt.n

Where x=540, σ=225

Z=-1.645

540+(-1.645)\*225

169.875

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

For profit 1

stats.norm.cdf(0,5,3)

0.0477903522728147

For profit 2

Stats.norm.cdf(0,7,4)

0.040059156863817086

Profit 1 has a larger probability of making a loss in a given year