**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



1. 0.5
2. 0.6987

* We have a normal distribution with 45,8
* Let X be the amount of time it takes to complete the repair on a customer's car. To finish in one hour you must have X ≤ 50 so the question is to find P(X > 50).
* P(X > 50) = 1 - P(X ≤ 50).
* Z = (X -)/= (X - 45)/8.0Thus the question can be answered by using the normal table to P(X ≤ 50) = P(Z ≤ (50 - 45)/8) = P(Z ≤ 0.625)=73.4%
* Probability that the service manager will not meet his demand will be.

= 100-73.4 =26.6% or 0.2676

(> pnorm(50, mean=45, sd=8, lower.tail=FALSE)= 0.2659855)

2.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.

* Mean = 38,SD = 6
* Z score = (Value - Mean)/SD
* Z score for 44  = (44 - 38)/6  = 1  =>  84.13 %
* People above 44 age = 100 - 84.13 =  15.87%  ≈  63    out of 400
* Z score for 38  = (38 - 38)/6 = 0 => 50%

1. More employees at the processing center are older than 44 than between 38 and 44. = **FALSE**

* Hence People between 38 & 44 age = 84.13 - 50 = 34.13 % ≈ 137 out of 400

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

* Z score for 30  = (30 - 38)/6 =  -1.33  =  9.15  %   ≈ 36 out of 400

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.
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

* **from** scipy **import** stats

**from** scipy.stats **import** norm

stats**.**norm**.**interval(0.99,100,20)

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.

* Range is Rs (-77.38865513011706, 1157.388655130117) in Millions

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

* 5th percentile of profit (in Million Rupees) is 23.4

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

* C:0.0477903522728147
* P(x<0) 0.040059156863817086