**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. The work begins after 10 min, so the average time increase from 45min to 55min.**

**for normal distribution: -**

**z = (X-μ)/б**

**= (60-55)/8**

**= 0.625**

**1 - stats.norm.cdf (0.625) = 0.26598552904870054**

**Therefore, the answer is (B)=0.2676**

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. False, it will shift the mean to 44 i.e. *μ* = 38 + *σ* =6 which is not possible.**

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

**Ans. True, Z=(X-µ)/ *σ***

**P (X≤30) = p (Z ≤ (30-38)/6) =p(Z≤-1.33) = 0.0918(using z table)**

**Expected count=0.0918\*400= 36.72**

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.

**Ans. 2X1 will be greater scale version than X1+X2, As both are independent normal random variables**

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. scipy.stats.norm.ppf(0.995,100,20)**

**151.516586070978**

**scipy.stats.norm.ppf(0.005,100,20)**

**48.483413929021985**

**So the right answer is D(48.5,151.5)**

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.

**Ans. scipy.stats.norm.ppf (0.025,45\*5,3) -> 219.1201**

**scipy.stats.norm.ppf (0.975,45\*5,3) -> 230.8799**

**scipy.stats.norm.ppf (0.025,45\*7,3) -> 309.1201**

**scipy.stats.norm.ppf (0.975,45\*7,3) ->320.8799**

**The Rupee Range will be [219.12, 230.87] + [309.12, 320.87] = [528.24, 551.74]**

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

**Ans. scipy.stats.norm.ppf (0.05,45\*7,3) # 310.0654**

**scipy.stats.norm.ppf (0.05,45\*5,3) # 220.0654**

**5th percentile of profit (in Rupees) = 310.0654+ 220.0654 = 530.1308**

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

**Ans. Division 2 with distribution N (7, 42)**