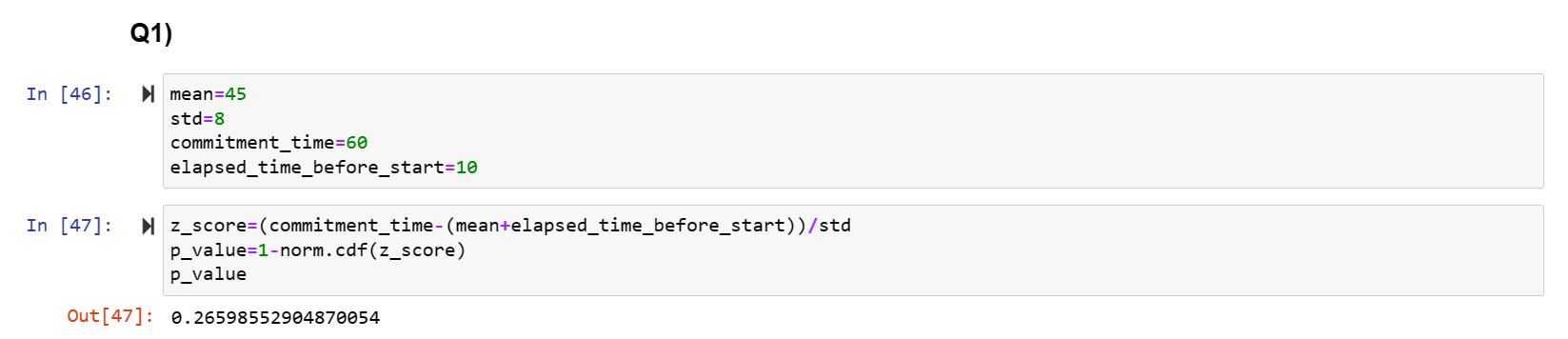
**Topics: Normal distribution, Functions of Random Variables**

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

**Answer:** Option 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.



**Answer:** False, because the probability of employees older than 44 is less than the probability of employees between 38 and 44.

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



**Answer:** True, Because the expected probability is more than 36 i.e., 36.4844

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.

**Answer:**

(i) 2X**1** ~ *N*(2 μ, 22 σ2)

If X1  follows normal distribution with mean μ and Variance = σ2 then 2X1 will also follow the normal distribution

Mean = 2μ and Variance = 4σ2

(ii) *X*1 + *X*2~ *N*(μ+ μ, σ2+ σ2) ~ *N*(2 μ, 2 σ2)

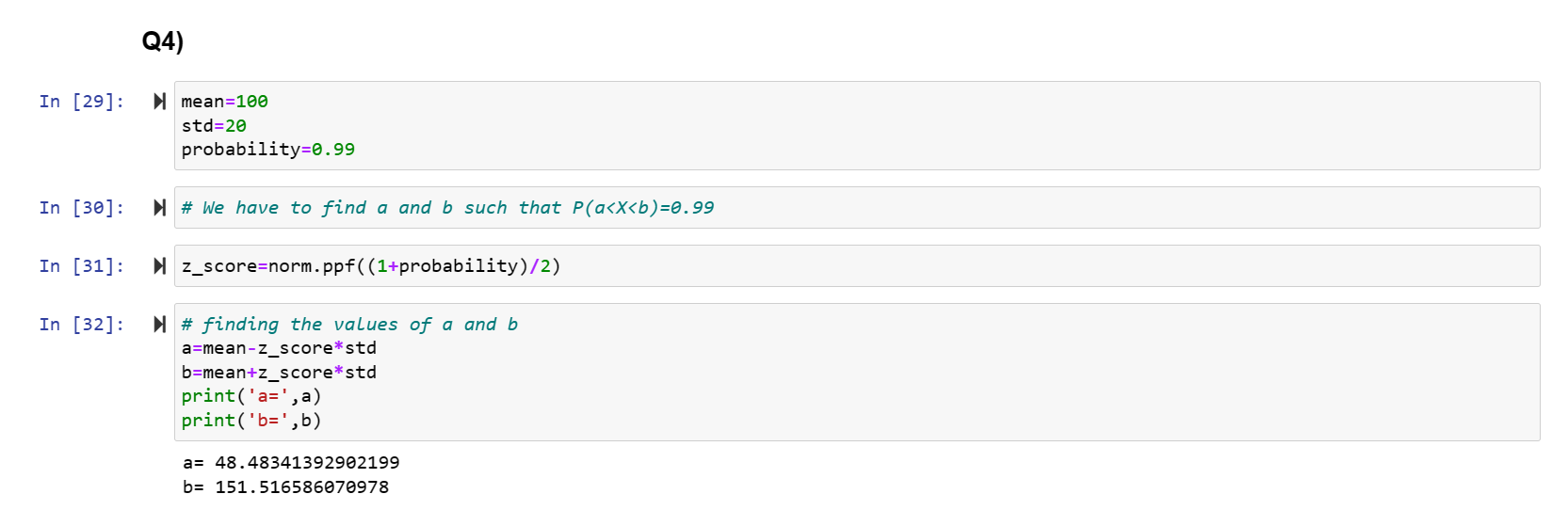
If X1  follows normal distribution with mean μ and Variance = σ2 then X1+X2 will also follow the normal distribution

Mean = μ+ μ = 2 μ and Variance = σ2+ σ2 = 2 σ2

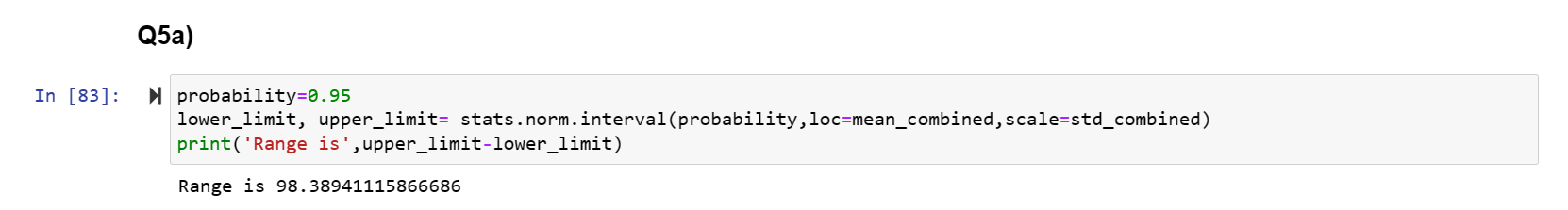
**Discussion:** Both 2X1 and X1+X2 will have same mean 2μ , but the variance differ Variance of 2X1 is 4 σ2 but the Variance of X1+X2 is 2 σ2 i.e., Variance of 2X1 is 2(Variance of X1+X2).

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

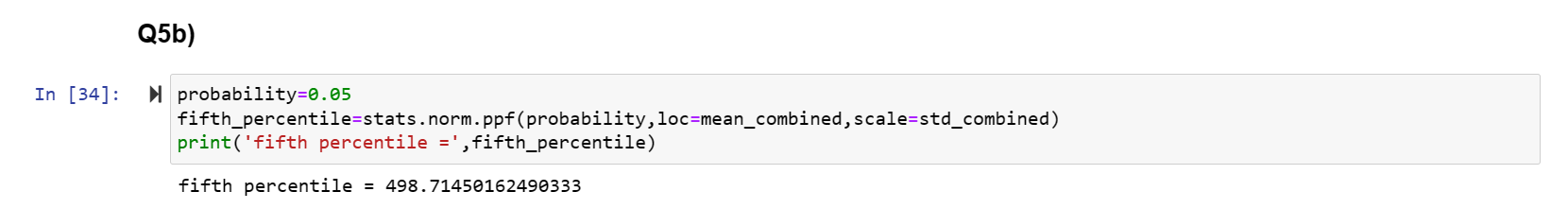
**Answer:** Option D. 48.5, 151.5



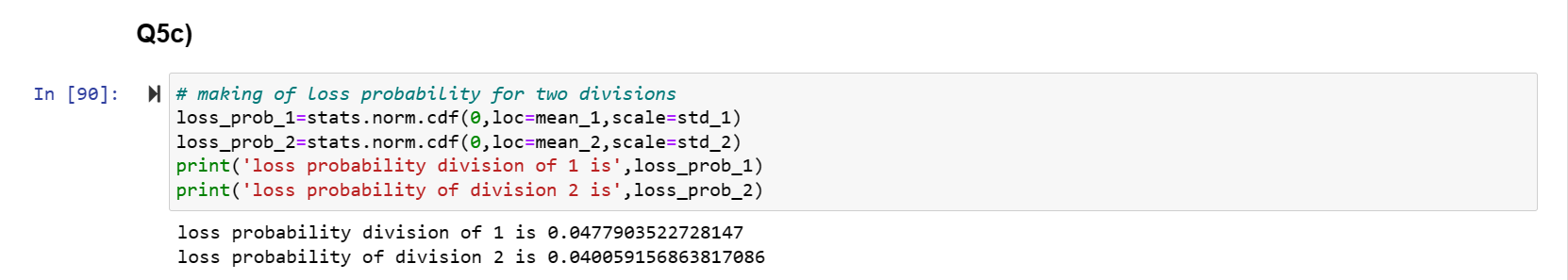
1. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions Profit1 ~ N(5, 32) and Profit2 ~ N(7, 42) respectively. Both the profits are in $ Million. Answer the following questions about the total profit of the company in Rupees. 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.



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



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



**Answer:** The division 1 has the larger probability of making a loss in a year.