

Normal Distribution Exercises

Exercise 1: Let X be a random variable following the standard normal distribution $N(0,1)$. Express, using the cumulative distribution function (CDF) of X , and then calculate (using the table) the following probabilities:

$P(2.1 \leq X \leq 2.53)$, $P(-1.11 \leq X \leq 1.37)$, $P(X \leq 2.53)$, $P(X > 1.15)$, $P(X > -2.5)$, $P(|X| \leq 2.05)$

Exercise 2: If X follows a normal distribution $N(35, 5)$, calculate:

$P(X < 25)$, $P(37.5 \leq X \leq 40)$, $P(32.5 \leq X \leq 37.5)$

Exercise 3: A researcher studied the average age at which children speak their first words. A study conducted on a sample of 1,000 children shows that the first words appear, on average, at 2 months with a standard deviation of 1.5 months. Assuming the ages are normally distributed, we want to:

1. Estimate the proportion of children who spoke their first words before 5 months.
 2. Estimate the proportion of children who spoke their first words after 6 months.
 3. Estimate the proportion of children who spoke their first words between 3 and 5 months.
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Additional Exercises

Exercise 4: We are interested in the lifespan of a sample of 100 laboratory mice after an injection of a molecule at birth. The lifespan of these mice is observed to follow a normal distribution with a mean of 400 days and a standard deviation of 8 days.

1. How many mice are expected to have a lifespan between 390 and 420 days?
 2. What lifespan corresponds to the 3rd quartile?
 3. What lifespan corresponds to the 3rd decile?
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Exercise 5: A survey was conducted among families of 4 members to study their milk consumption over one month. Among all respondents, the consumption

follows a Gaussian population with a mean of 25 liters and a standard deviation of 6 liters.

To design a marketing campaign, we want to know the percentage of low consumers (less than 10 L/month) and the percentage of high consumers (more than 30 L/month).

1. Calculate these two percentages.
2. Below how many liters are 75% of the consumers?
3. How many liters do half of the consumers consume at most?
4. Above what consumption level are 1/3 of the population and 2/3 of the population?