

# Problem Set 3

ECN 301E - Fall 2024

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## Question 1

Define the following terms in your own words.

- Normal distribution and standard normal distribution
- Chi-squared distribution
- t distribution
- F distribution
- Independently and identically distributed (i.i.d)
- Sampling distribution
- Law of large number
- Central limit theorem
- Consistency
- Asymptotic distribution

## Question 2

Compute the following probabilities.

- If  $Y$  is distributed  $N(1, 4)$ , find  $P(Y \leq 3)$ .
- If  $Y$  is distributed  $N(3, 9)$ , find  $P(Y > 0)$ .
- If  $Y$  is distributed  $N(50, 25)$ , find  $P(40 \leq Y \leq 52)$ .

## Question 3

Compute the following probabilities.

- If  $Y$  is distributed  $\chi_4^2$ , find  $P(Y \leq 7.78)$ .
- If  $W$  is distributed  $\chi_{10}^2$ , find  $P(W > 18.31)$ .
- If  $Y$  is distributed  $F_{10,+\infty}$ , find  $P(Y > 1.831)$ .
- Why are the answers to (2) and (3) the same?
- If  $Y$  is distributed  $\chi_1^2$ , find  $P(Y \leq 1.0)$ .

## Question 4

Suppose  $Y_1, Y_2, \dots, Y_n$  are i.i.d. random variables, each distributed  $N(10, 4)$ .

- Compute  $P(9.6 \leq \bar{Y} \leq 10.4)$  when  $n = 20$ , when  $n = 100$  and when  $n = 1000$ .
- Suppose  $c$  is a positive number. Show that  $P(10 - c \leq \bar{Y} \leq 10 + c)$  becomes close to 1 as  $n$  grows large.
- Use your answer in (b) to argue that  $\bar{Y}$  converges in probability to 10.