

EE23010: Grading on the Gaussian Curve

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I. ABSTRACT

This document describes the 'grading on a bell curve' technique for grading students in the course 'EE23010: Probability and Random Processes' in Fall 2023, offered by Dr. G V V Sharma.

II. GRADING AT IITH:

Upon the completion of a course, the instructor can award a student any of the following eight passing grades:

Grade	Grade Points
A+	10
A	10
A-	9
B	8
B-	7
C	6
C-	5
D	4

TABLE 0

GRADE POINTS CORRESPONDING TO GRADES

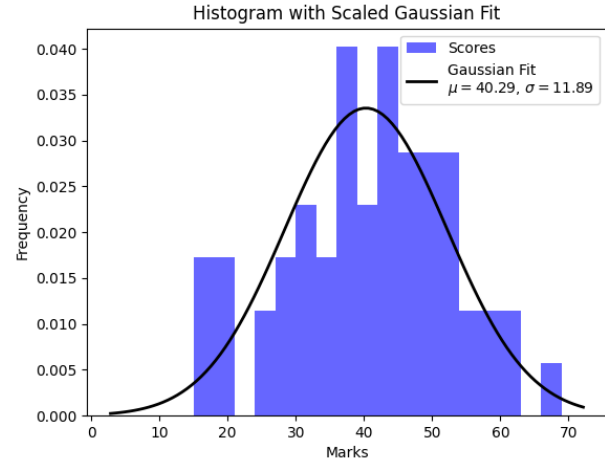


Fig. 0. Distribution

Grade	Lower Bound	Upper Bound
A	$\mu + 2.5k\sigma$	None
A-	$\mu + 1.5k\sigma$	$\mu + 2.5k\sigma$
B	$\mu + 0.5k\sigma$	$\mu + 1.5k\sigma$
B-	$\mu - 0.5k\sigma$	$\mu + 0.5k\sigma$
C	$\mu - 1.5k\sigma$	$\mu - 0.5k\sigma$
C-	$\mu - 2.5k\sigma$	$\mu - 1.5k\sigma$
D	None	$\mu - 2.5k\sigma$

TABLE 0

GRADE BOUNDARIES

III. GRADING CONSTRAINTS

While no strict constraints exist on grading, as customary at IITH, the average passing grade awarded is B-, corresponding to 7 grade points.

IV. GAUSSIAN STATISTICS

The number of students enrolled in the course is 58. The mean and the standard deviation of the scores are:

$$\mu = 40.29$$

$$\sigma = 11.89$$

As the number of students is somewhat large, the distribution of scores can be approximated as a Gaussian distribution $X \sim \mathcal{N}(\mu, \sigma^2)$, as shown in the plot below:

V. METHODOLOGY

The boundaries listed above had been used for defining the boundaries for the grades.

This ensures that the average grade obtained is B- irrespective of the values of μ , σ or k . The value of k is a parameter chosen as described below.

While the grade 'A+' was avoided in this course, we can extrapolate the above-mentioned pattern and define its lower boundary as

$$\mu + 3.5k\sigma \quad (1)$$

The Academic Handbook and the transcript mention that A+ is awarded to those with "Outstanding performance in the Course, typically in the top 2% of the class".

Thus, for an ideal Gaussian Distribution of scores, the minimum bound x above which a student scores 'A+' is such that:

$$1 - f_X(x) = 0.02 \quad (2)$$

$$\Rightarrow Q\left(\frac{x - \mu}{\sigma}\right) = 0.02 \quad (3)$$

$$\Rightarrow \frac{x - \mu}{\sigma} = Q^{-1}(0.02) \quad (4)$$

$$\Rightarrow x = \mu + Q^{-1}(0.02)\sigma \quad (5)$$

$$\Rightarrow x = \mu + 2.053749\sigma \quad (6)$$

Comparing (1) and (6),

$$2.053749 = 3.5k \quad (7)$$

$$\Rightarrow k = 0.586785 \quad (8)$$

VI. RESULT

The distribution of grades is as follows:

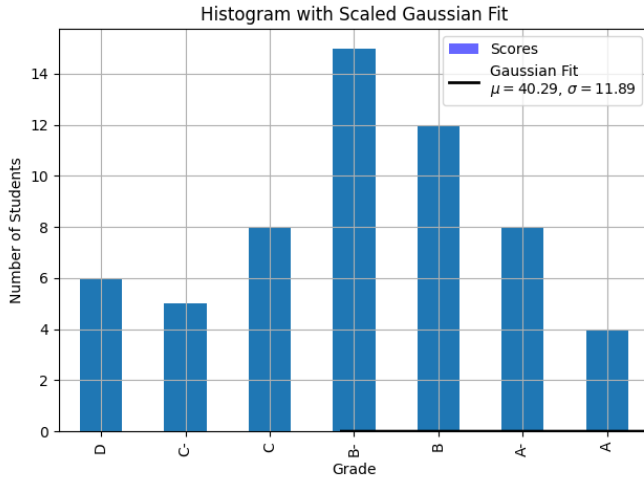


Fig. 0. Distribution

The average grade obtained in the course is 7.086, and the distribution is achieved. The grades are shown in the excel sheet.