

Social Studies 201
November 3, 2004

Normal distribution of grades?

The mean grade in all Faculty of Arts classes in the 1991 Fall semester was 69 and the standard deviation of grades was 14. Assuming that the distribution for these grades was a normal distribution, calculate the percentage of grades in each of the intervals < 50 , $50 - 60$, $60 - 70$, $70 - 80$, $80 - 90$, and 90 plus.

The actual percentage distribution of grades in all Faculty of Arts classes in the 1991 Fall semester is given in Table 1. Write a short note comparing the distribution in Table 1 with the percentage distribution of grades for the normal distribution.

Table 1: Per Cent Distribution of Grades, All Faculty of Arts Classes, 1991 Fall

Grade	Per Cent of Grades
< 50	7.5%
$50 - 60$	16.3%
$60 - 70$	26.6%
$70 - 80$	30.0%
$80 - 90$	16.6%
90 plus	3.0%

Answer.

For this question, $\mu = 69$ and $\sigma = 14$.

To answer this question, it is necessary to find the areas under the normal curve between each of the grades 50, 60, 70 and so on. For $X = 50$ means $Z = (X - \mu)/\sigma = (50 - 69)/14 = -1.36$ and the area below this is 0.0869 or 8.7%.

X	Z	A Area
50	-1.36	0.4131
60	-0.64	0.2389
70	0.07	0.0279
80	0.79	0.2852
90	1.50	0.4332

The proportion between 50 and 60 is $0.4131 - 0.2389 = 0.1742$ or 17.4%. The proportion between 60 and 70 is $0.2389 + 0.0279 = 0.2668$ or 26.7%. Going through each of these intervals gives the distribution of test scores shown in the 'Normal' column of Table 2.

Comparing the 'Actual' column with the 'Normal' column of Table 2 shows that the actual distribution of grades is fairly close to a normally distributed set of grades. For the 60-70 interval the percentages are almost identical. The normal distribution indicates 26.1% of the grades would be under 60, whereas there are only 23.8% in 1991 Fall. In contrast, there were more grades awarded in the 70-90 range, than what would be predicted on the basis of the normal distribution. There were 46.6% of all grades in this range, but there would have been only 40.5% if the distribution had been exactly normal. Finally, the normal distribution predicts more than double the number of 90s that were actually awarded.

Table 2: Per Cent Distribution of Grades, Normal Distribution and All Faculty of Arts Classes, 1991 Fall

Grade	Per Cent of Grades		
	Normal	Actual	Difference
< 50	8.7%	7.5%	1.2
50 - 60	17.4%	16.3%	1.1
60 - 70	26.7%	26.6%	0.1
70 - 80	25.7%	30.0%	-4.3
80 - 90	14.8%	16.6%	-1.8
90 plus	6.7%	3.0%	3.7
Total	100.0%	100.0%	0.0