Using the table in Normal Dist'ns

1. Normal dist'ns, standard (mean 0, st dev 1)
   What proportion of scores lie between ___ and ___ or above ___, etc.?
   (pages 2 and 3)

2. Normal dist'ns, standardizing scores (page 4)

3. Normal dist'ns, general
   What proportion of scores lie between ___ and ___ or below ___, etc? (page 5)

4. Normal dist'ns, standard (mean 0, st dev 1)
   What score is at the ___ percentile? (page 6)

5. Normal dist'ns, general
   What score is at the ___ percentile?
   (page 7)

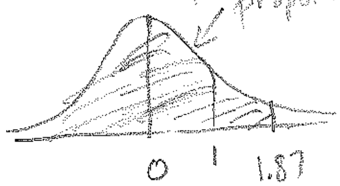
Normal dist'ns, standard
What proportion of scores lie above ___ or between ___ ... ?

Example 1. We have a standard normal dist'n, which means mean 0 and standard deviation 1.

a. What proportion of scores lie below 1.87?

Solution

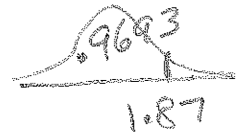
proportion



See the normal table

Answer .9693

or 96.93%



b. What proportion of scores lie above 1.87?

Solution

The table only shows left areas. But the total area under the curve is 1.0000.

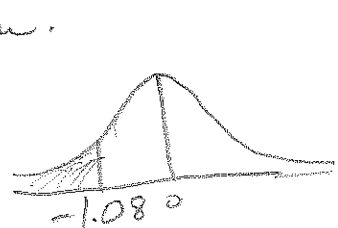
So

= .0307

Answer .0307 or 3.07%

c. What proportion of scores lie below −1.08?

Solution.



See the normal table

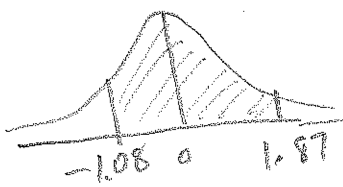
Answer .1401

or 14.01%

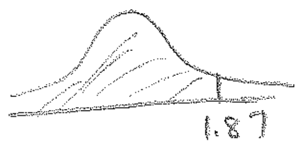
1. Normal dist'n, $\mu = 0$, $\sigma = 1$.

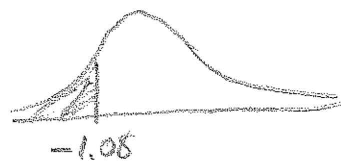
d. What proportion of scores lie between -1.08 and 1.87?

Solution:



Our table only has left-hand-areas, not "between" areas. But we can get the "between" area by taking the difference of two left-hand areas.

= 

− 

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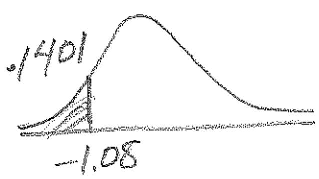
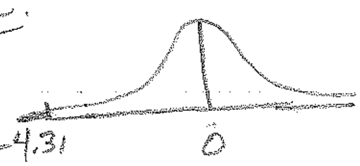
− 

$$= \begin{array}{r} .9693 \\ -\ .1401 \\ \hline .8292 \end{array}$$

Answer .8292 or 82.92%

e. What proportion of scores lie below -4.31?

Solution:



There is no score in the table this low.

From our diagram it is clear the area must be very small.

The table gives us 

So the proportion of scores below -4.31 is <u>less than</u> <u>.0002</u> or <u>0.02%</u>. That is the answer is approximately zero.

Normal dist'ns - standardizing scores

All normal dist'ns have a similar shape, but different locations (mean) and different width (standard deviation).

We can standardize a score in any normal dist'n so that we can use the standard normal table with it.

Example. Suppose we have a normal dist'n with mean 25 and standard deviation 7. We want to find what proportion of scores are below 20 in that dist'n.

Solution:

Standardize the score $Z = \frac{X - \mu}{\sigma}$

$$Z_{20} = \frac{20-25}{7}$$

$$Z_{20} = \frac{-5}{7} = -0.7142857$$

Since our table only has two decimal places in the scores we look up, we round to two decimal places $Z_{20} = -0.71$

In the table area = .2389

So the score 20 has .2389 or 23.89% of the scores below it.

Normal dist'ns: General

What proportion of the scores are below ___ or above ___ or between ___ and ___?

Example: In a normal dist'n with mean 12.71 and standard deviation 1.83, what proportion of the scores are between 13 and 20?

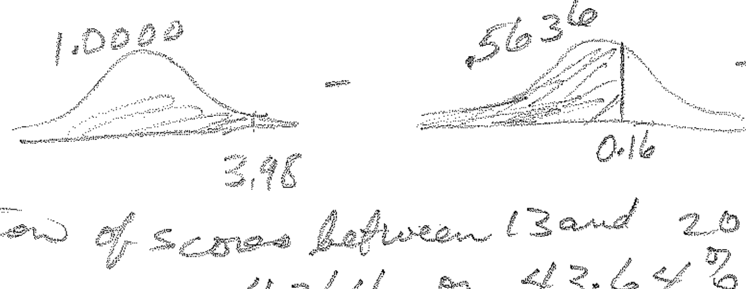
$$z = \frac{X - \mu}{\sigma}$$

Solution:

$$z_{13} = \frac{13 - 12.71}{1.83} = 0.158 \approx 0.16$$

$$z_{20} = \frac{20 - 12.71}{1.83} = 3.98$$

Note that z = 3.98 is not on the normal table, and that z = 3.49 is the closest value on it. The area below 3.49 is 0.9998. So the area below 3.98 must be larger than 0.9998. Since the total area under the curve is 1.0000, the area below 3.98 is approx 1.0000, so we will use that.



$$\begin{array}{r} 1.0000 \\ -.5636 \\ \hline .4364 \end{array}$$

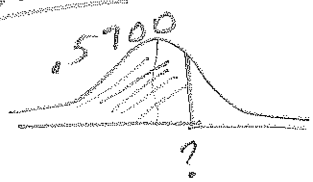
The proportion of scores between 13 and 20 is .4364 or 43.64%

Normal dist'ns: standard.

What score is at the — th percentile?

Example: In a normal dist'n with mean 0, st dev 1, what score is at the 57th percentile?

Solution: That means 57% of the scores below it.



So we look in the table and find .5714 and .5675, but not .5700.

In this class, we will use the closest one, so that's .5714.

The z score for that is 0.18. So that is the answer.

The score of 0.18 has 57% of the scores below it.

Example: Normal dist'n, mean 0, st dev 1.
What score has 95% of the scores ABOVE it?

Solution:

so we look up .0050

So, when we look up .0500, we find .0505 and .0495.
They are equally close. We can use either.
So either $z = -1.64$ or $z = -1.65$ is correct.

Normal distns, general.

What score is at the — percentile?

__Example:__ In a normal dist'n with mean 12.3 and standard deviation 3.1, what score has 95% of the scores above it?

__Solution:__ First solve the problem for a standard normal dist'n. Then "unstandardize" the answer.

So we look in the table and find $z = -1.64$ or -1.65.
We choose to use -1.64. (Either is correct.)

Recall
$$z = \frac{x - \mu}{\sigma}$$

Before we knew μ, σ, and x and found z.
Now, we know z, μ, σ and will find x.
You can derive the formula using algebra, or just copy this in your notes

$$x = \mu + \sigma \cdot z$$

So here $x = 12.3 + 3.1 \cdot (-1.64)$
$= 12.3 - 5.084$
$= 7.216$

So the score of 7.216 has 95% of the scores above it.