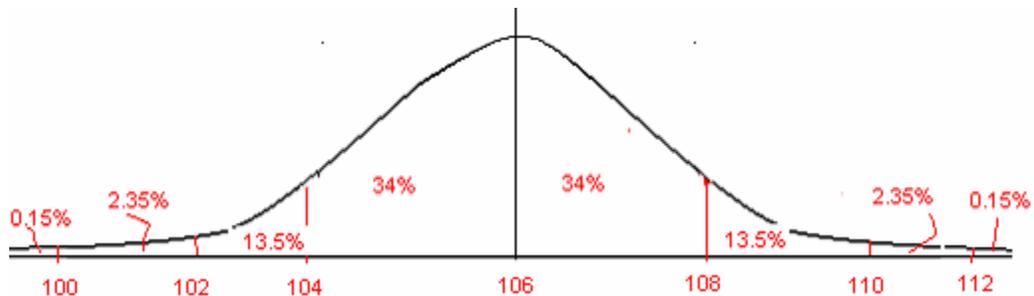


1. A machine is used to put nails into boxes. It does so such that the actual number of nails in a box is normally distributed with a mean of 106 and a standard deviation of 2.

The first step is to draw the Normal curve with 8 regions, and to then label the 7 vertical dividing lines with the mean plus/minus one/two/three standard deviations:



- a) What percentage of boxes contain
- i more than 104 nails? 84%
  - ii What percentage of boxes contain more than 110 nails? 2.5%
  - iii What percentage of boxes contain less than 108 nails? 84%
  - iv What percentage of boxes contain less than 100 nails? 0.15%
  - v What percentage of boxes contain between 102 and 112 nails?  
97.35%
  - vi What percentage of boxes contain between 100 and 106 nails?  
49.85%

These values come from adding the percentage values in the areas indicated in the question.

- b) What is the z-score for a box containing
- i. 101 nails?  $(101-106)/2 = -2.5$
  - ii. 103 nails?  $(103-106)/2 = -1.5$
  - iii. 107 nails?  $(107-106)/2 = 0.5$

To compute a z-score subtract the given mean (in this problem 106) from the value given in the problem, and then divide by the given standard deviation (in this problem 2). The z-score is the number of standard deviations above the mean corresponding to the given value. (Negative values are interpreted as *below the mean*.)

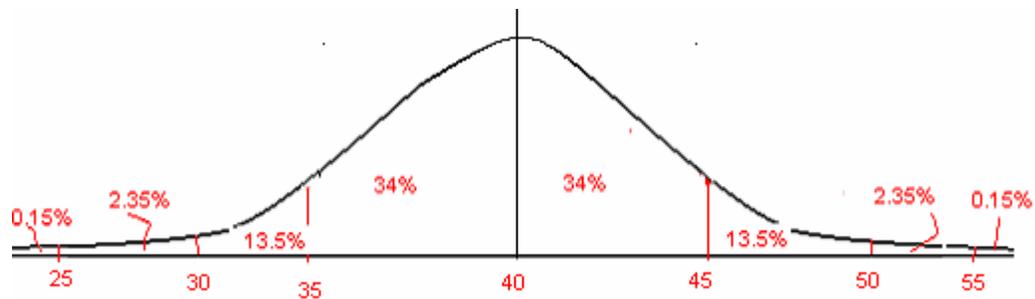
- c) What is the percentile for a box containing

- i 101 nails ? Table value 0.0062. Percentile 0.62% rounded up to **1<sup>st</sup>**
- ii 103 nails ? Table value 0.0668. Percentile 6.68% rounded up to **7<sup>th</sup>**
- iii 107 nails? Table value 0.6915. Percentile 69.15% rounded up to **70<sup>th</sup>**

These answers use the **Percentile Z-Table** from Section 2E to convert the z-scores from part b into percentiles. The Table (in a simplified form) will be provided on the Second Test.

2. The heights of the people if the planet Ixx are normally distributed with a mean of 40 inches and a standard deviation of 5 inches. [They are a vertically diverse people.]

The first step is to draw the Normal curve with 8 regions, and to then label the 7 vertical dividing lines with the mean plus/minus one/two/three standard deviations:



- a) What percentage of Ixxians are

- i over 30 inches tall? 97.5%
- ii over 45 inches tall? 16%
- iii under 50 inches tall? 97.5%
- iv under 40 inches tall? 50%
- v between 35 and 55 inches tall? 83.85%
- vi between 25 and 35 inches tall? 15.85%

These values come from adding the percentage values in the areas indicated in the question.

- b) What is the z-score for an Ixxian of height

- i. 32 inches?  $[32-40]/5 = -1.6$
- ii. 47 inches  $[47-40]/5 = 1.4$
- iii. 51 inches  $[51-40]/5 = 2.2$

To compute a z-score subtract the given mean (in this problem 40) from the value given in the problem, and then divide by the given standard deviation (in this problem 5). The z-score is the number of standard deviations above the mean corresponding to the given value. (Negative values are interpreted as *below the mean*.)

c) What is the percentile for an Ixxian of height

- i. 32 inches? Table Value = 0.0548. Percentile 5.48 rounded up to 6<sup>th</sup>
- ii. 47 inches? Table Value = 0.9192. Percentile 91.82 rounded up to 92<sup>nd</sup>
- iii. 51 inches? Table Value = 0.9861. Percentile 98.61 rounded up to 99<sup>th</sup>

These answers use the **Percentile Z-Table** from Section 2E to convert the z-scores from part b into percentiles.

The Table (in a simplified form) will be provided on the Second Test.

d) What is the height of an Ixxian who is at the

- i. 25<sup>th</sup> percentile? z-score roughly -0.7 Value = (-0.7)(5)+40 = 36.5"
- ii. 40<sup>th</sup> percentile? z-score roughly -0.25 Value = (-0.25)(5)+40 = 38.75"
- iii. 60<sup>th</sup> percentile? z-score roughly 0.27 Value = (0.27)(5)+40 = 41.35"
- iv. 86<sup>th</sup> percentile? z-score roughly 1.08 Value = (1.08)(5)+40 = 45.4"

This time we need to first read from the table to get the z- score. The scores do not fall exactly on values on the tables, so it requires a little guesswork. Answers may therefore be different to mine; but they should be close.

To convert from z-score to actual value, reverse the process used in part b. Multiply by the standard deviation (in this case 5) and then add the mean (in this case 40)