

Z-scores represent how many standard deviations from the mean the X-value is.

On my computer's music library, suppose all of the songs have a mean duration of 242.4 seconds with a standard deviation of 114.51 seconds, and is approximately normal.

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

- What is the distribution and parameter(s)?
 $Y \sim N(\mu, \sigma) \Rightarrow Y \sim N(242.4, 114.51)$
- The song *Hollow Skies* (from *Final Fantasy VII Remake*), by Nobuo Uematsu, is 175 seconds long. Calculate the z-score, and compare with next one

$$P(Y < 175) = P\left(Z < \frac{175 - 242.4}{114.51}\right) = P(Z < -0.589) = 0.278$$

statdistributions.com: z= -0.589, mean=0, stddev=1, LT

<http://www.statdistributions.com/normal?z=-0.589&tail=3>

- The song *One-Winged Angel - Rebirth* (from *Final Fantasy VII Remake*), by Nobuo Uematsu, is 619 seconds long. Calculate the z-score. What percentiles are each of the songs?

$$P(Y < 619) = P\left(Z < \frac{619 - 242.4}{114.51}\right) = P(Z < 3.289) = 0.999$$

statdistributions.com: z= 3.289, mean=0, stddev=1, LT

<http://www.statdistributions.com/normal?z=3.289&tail=3>

Comparison: *Hollow Skies* is less than one standard deviation **below** the mean. *One-Winged Angel -Rebirth* is over 3 standard deviations **above** the mean.

A company makes new batteries targeted at owners of MP3s. One claims that its mean battery life is 11 hours with a standard deviation of 1.5 hours. Battery life follows a normal distribution.

- What is the distribution and parameter(s)?
 $X \sim N(\mu, \sigma) \Rightarrow X \sim N(11, 1.5)$
- What is the probability that the batteries last for an 8-hour day at the beach? (find the probability that the batteries last at most 8 hours, or up to 8 hours)

$$P(X < 8) = P\left(Z < \frac{8 - 11}{1.5}\right) = 0.023$$

statdistributions.com: z= 8, mean=11, stddev=1.5, LT

<http://www.statdistributions.com/normal?z=8&mean=11&sd=1.5&tail=3>

- What are the shortest 5% of battery lifespans? 8.532 hours

statdistributions.com: p-value=0.05, mean=11, stddev=1.5, LT

<http://www.statdistributions.com/normal?p=0.05&mean=11&sd=1.5&tail=3>