Inferential Statistics: Z and Raw Score, Z Score Facts and Normal Curve

Inferential Statistics

- Group of people solve difficult problem – apply to larger set
- Inferential statistics – make general conclusions going beyond particular research
- *Z* scores, the normal curve, sample versus population and probability

Z Score

- Particular score fitting in overall group of scores
- how much it is above or below the average
- I am good at math's (1 means not at all , 8 means very good) – mean is 4 and SD is 2. If I rate myself 8 it means it is 8 - 4 = 4. It is more than SD by 2.
- *Z* score is the number of standard deviations the actual score is above or below the mean. If the actual score is above the mean, the *Z* score is positive. If the actual score is below the mean, the *Z* score is negative.
- SD becomes a kind of yardstick, a unit of measure in its own right.
- Shows where a particular score fall on NPC

Z Score and Raw Score

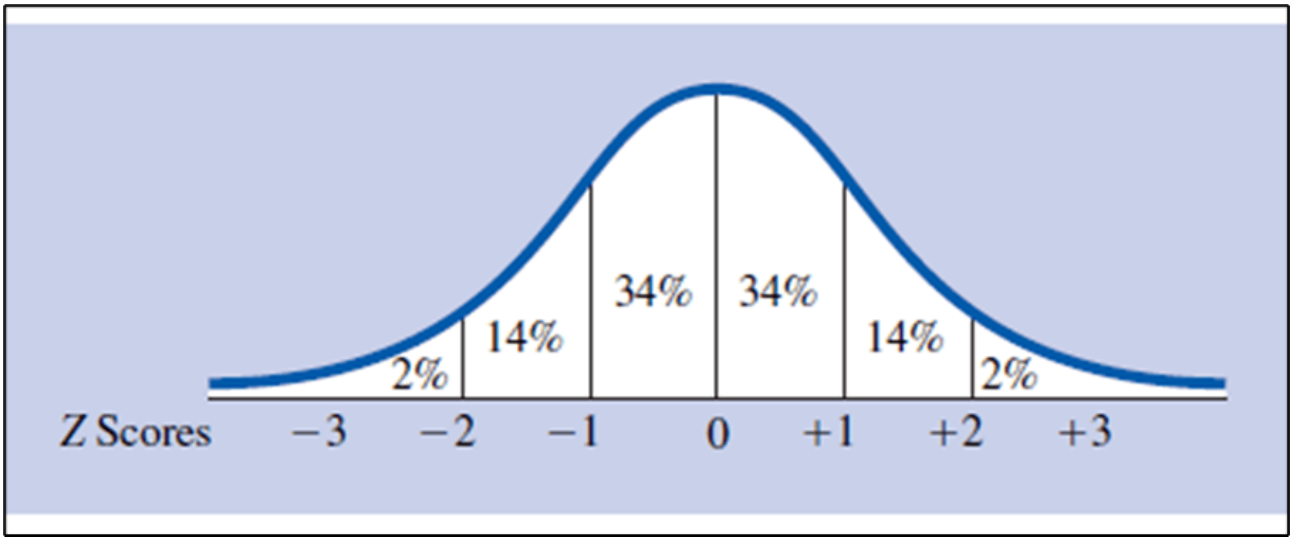
- raw score is ordinary score (or any number in a distribution) before it has been made into a *Z* score or otherwise transformed
- Ruler with cm & inches – raw score and z score
- A *Z* score is the number of standard deviations by which the raw score is above or below the mean.
- $Z = \frac{X - \overline{X}}{\text{SD}}$
- Deviation Score = $Z \times \text{SD}$
- If you know Z score, mean and standard deviation – you can find the number

Z Score Facts

- The mean of any distribution of *Z* scores is always 0.
- Sum of positive and negative scores is zero
- Standard Deviation of Z Score distribution is 1
- If a distribution of raw scores is positively skewed, the distribution of *Z* scores will also be positively skewed.
- A *Z* score is also called a *standard score*. *Z* scores have standard values for the mean and the standard deviation. *Z* scores provide a kind of standard scale of measurement for any variable. (Sometimes *standard score* is used only when the *Z* scores are for a distribution that follows a normal curve.)

Normal Curve

- Unimodal symmetrical curve
- Researchers compare actual distribution to normal curve (mathematical distribution)
- Distribution do not match normal curve perfectly
- Called *Gaussian distribution* after the astronomer Karl Friedrich Gauss
- Recall numbers – affected by noise, mood, letter combinations
- Unimodal score
- Unimodal distribution with most of the scores near the middle and fewer at the extremes. It also creates a distribution that is symmetrical, because the number of letters recalled is as likely to be above as below the middle



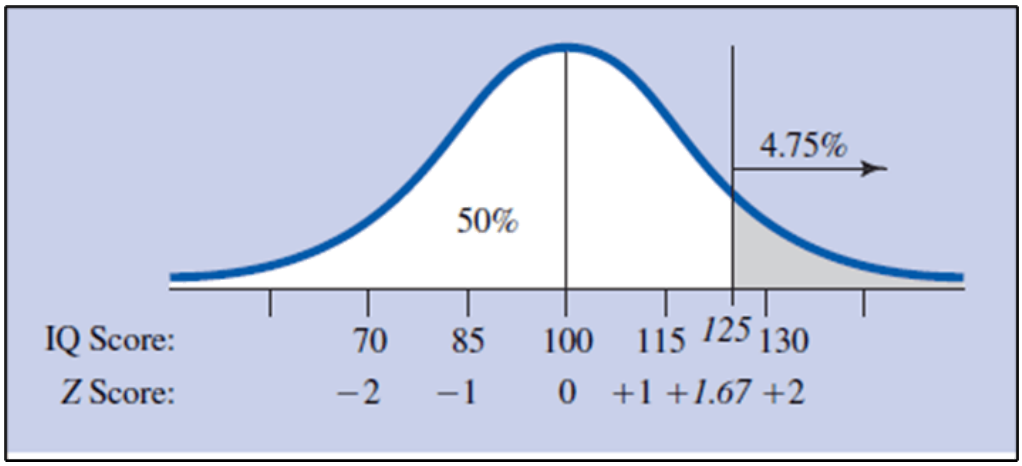
- Example IQ 100 and SD 15 then range is 85 - 115
- labeled "% Mean to *Z*," gives the percentage of scores between the mean and that *Z* score.

Tables of the Normal Distribution

Probability Content from -oo to Z

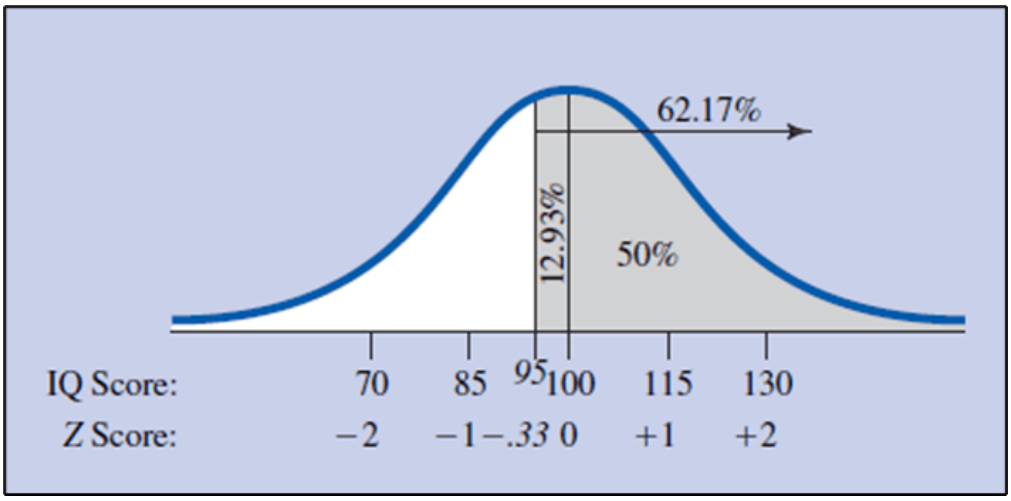
Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

- IQ scores where *M* = 100 and *SD* = 15.
- *Example 1*: If a person has an IQ of 125, what percentage of people have higher IQs?
- *Z* = (x-m) /SD, *Z* = (125 – 100) /15 =+ 1.67.



If a person has an IQ of 95, what percentage of people have higher IQs?

$$Z = \frac{X - M}{\text{SD}} = \frac{95 - 100}{15} = -0.33$$



- Example IQ 100 and SD 15 then range is 85 - 115
- labeled "% Mean to *Z*," gives the percentage of scores between the mean and that *Z* score.
- with a *Z* score of 1.67, the number of scores above it has to be somewhere between 16 % and 2 % .
- 1.67 in the "*Z*" column goes with 4.75 in the "% in Tail" column.

Sample and Population

- Population entire group of people to which a researcher intends the results of a study to apply; larger group to which inferences are made on the basis of the particular set of people (sample) studied.
- Sample scores of the particular group of people studied; usually considered to be representative of the scores in some larger population.
- Cooking rice – whole pot is population, you taste a sample
- Wy, we research? To make generalizations and predictions
- Study sample of individuals who are believed to be representative of the general population
- The sample is what is studied, and the population is an unknown about which researchers draw conclusions based on the sample
- Random selection – put name on balls and mix and shake it and select blind-foldedly – random process that each member has equal chance of getting selected
- Haphazard selection – pick a population from extreme values
- In random sampling, the sample is chosen from among the population using a completely random method, so that each individual has an equal chance of being included in the sample. In haphazard sampling, the researcher selects individuals who are easily available or who are convenient to study.
- Psychologists usually study samples and not populations because it is not practical in most cases to study the entire population.

- Sampling error – due to easy availability etc.
- Quota sampling can produce biasness, Interviewers were assigned a fixed number of persons to interview, with strict quotas to fill in all the categories that seemed important, such as residence, sex, age, race, and economic status.

Population Parameter and Sample Statistic

Population Parameter

- actual value of the mean, standard deviation, and so on, for the population; usually population parameters are not known, though often they are estimated based on information in samples.
- population mean μ .
- population variance σ^2 .
- population standard deviation σ .

Sample Statistics

- descriptive statistics, such as the mean or standard deviation, figured from the scores in a group of people studied.
- sample mean M .
- sample variance SD^2 .
- sample standard deviation SD .
- Rice is cooked – explains about the whole rice from sample. The mean, variance, and standard deviation of a population are called population parameters
- The mean, variance, and standard deviation you figure for the scores in a sample are called sample statistics

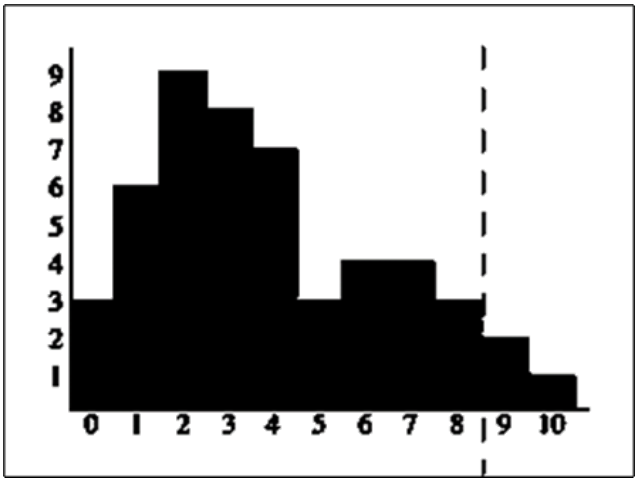
Probability

$$\text{Probability} = \frac{\text{Possible Successful outcomes}}{\text{All Possible Outcomes}}$$

- Probability - expected relative frequency of an outcome, the proportion of successful outcomes to all outcomes.
- Outcome - term used in discussing probability for the result of an experiment (or almost any event, such as a coin coming up heads or it is raining tomorrow) .
- Frequency is how many times something happens
- The relative frequency is the number of times something happens relative to the number of times it could have happened; that is, relative frequency is the proportion of times something happens.
- (A coin might come up heads 8 times out of 12 flips, for a relative frequency of 8 > 12, or 2 > 3.) Expected relative frequency is what you expect to get in the long run if you repeat the experiment many times. (In the case of a coin, in the long run you would expect to get 1/2 heads) . This is called the long run relative-frequency interpretation of probability.
- We also use probability to express how certain we are that a particular thing will happen. This is called the subjective interpretation of probability. Suppose that you say there is a 95 % chance that your favorite restaurant will be open tonight.
- Toss – chance of head or tail is 50 %
- In a class has 200 people in it, and 30 are seniors. If you were to pick someone from the class at random, the probability of picking a senior would be 30/200, or 0.15. This is because there are 30 possible successful outcomes (getting a senior) out of 20 possible outcomes

Range of Probability

Probability of getting 9 & above is 3/50



- A probability is a proportion, the number of possible successful outcomes to the total number of possible outcomes. A proportion cannot be less than 0 or greater than 1. In terms of percentages, proportions range from 0 % to 100 % .
- 0.15 probability indicates 15 % chance
- For example, $p < .05$ means "the probability is less than . 05."
- Probability for multiple outcomes – flip coin twice & get head both times
- Percentage of scores between any two *Z* scores is known. The percentage of scores between any two *Z* scores is the same as the probability of selecting a score between those two *Z* scores.
- Probability of a score being between the mean and a *Z* score of + 1 is about . 34

Conditional Probability

- Greater the number of exposures is, the greater is the number of words remembered. The actual number of words remembered from the list might well be different for people other than introductory students.
- Whenever possible, researchers report the proportion of individuals approached for the study who actually participated in the study. This is called the response rate.

Probability Rules – Addition, Multiplication, Conditional Cases

- The addition rule (also called the or rule) is used when there are two or more mutually exclusive outcomes
- "Mutually exclusive" means that, if one outcome happens, the others can't happen. For example, heads or tails on a single coin flip are mutually exclusive because the result has to be one or the other, but can't be both
- With mutually exclusive outcomes, the total probability of getting either outcome is the sum of the individual probabilities. Thus, on a single coin flip, the total chance of getting either heads (which is . 5) or tails (also . 5) is 1.0 (. 5 plus . 5) .
- Multiplication rule figures the probability of getting both of two (or more) independent outcomes. Independent outcomes are those for which getting one has no effect on getting the other. For example, getting a head or tail on one flip of a coin is an independent outcome from getting a head or tail on a second flip of a coin.
- The probability of getting both of two independent outcomes is the product of (the result of multiplying) the individual probabilities. For example, on a single coin flip, the chance of getting a head is . 5. On a second coin flip, the chance of getting a head (regardless of what you got on the first flip) is also . 5. Thus, the probability of getting heads on both coin flips is . 25
- A conditional probability is the probability of one outcome, assuming some other outcome will happen. That is, the probability of the one outcome depends on is conditional on the probability of the other outcome. Thus, suppose if you watch Examrace Videos, chances of scoring increases from 50 % to 80 % .

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