EXAM 2

CHAPTER 6: PROBABILITY & NORMAL DISTRIBUTION

$$\text{probability of A} = \frac{\text{number of outcomes classified as A}}{\text{total number of possible outcomes}}$$

- The probability of any specific outcome is a fraction or *proportion* of all possible outcomes
- Proportions and probabilities are equivalent

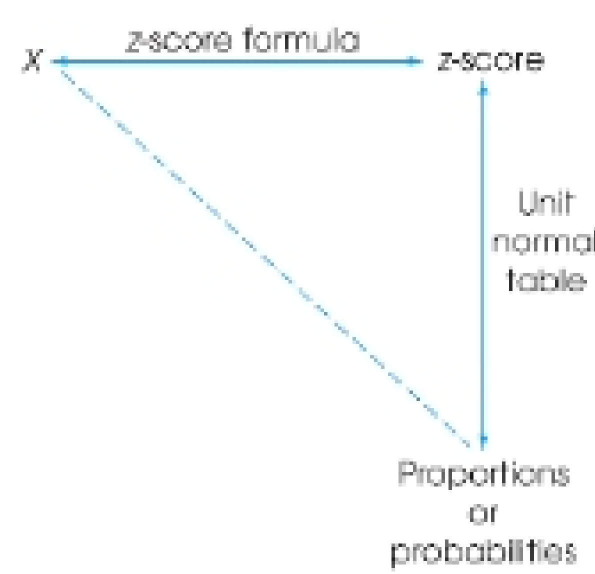
Random Sample- Each individual in the population has an equal chance of being selected

<u>Normal distribution</u> is a common shape:
- Symmetrical
- Highest frequency in the middle
- Frequencies taper off towards the extremes
- Transform the *X* values into *z*-scores
- Look up the proportions corresponding to the *z*-score values

Percentile rank - *the percentage of individuals in the distribution who have scores that are less than or equal to the specific score.*

1) Choosing random individuals who pass by yields a random sample----- FALSE
2) Probability predicts what kind of population is likely to be obtained-----FALSE
3) Find the proportion of the normal curve that corresponds to $z > 1.50$----- $\boldsymbol{p = 0.0668}$
4) For any negative *z*-scores, the tail will be on the right hand side.----FALSE (left)
5) If you know the probability, you can find the corresponding *z*-score-----TRUE
6) Membership in MENSA requires a score of 130 on the Stanford-Binet 5 IQ test, which has $\mu = 100$ and $\sigma = 15$. What proportion of the population qualifies for MENSA $\boldsymbol{p = 0.0228}$
7) It is possible to find the *X* score corresponding to a percentile rank----TRUE
8) Whenever you know a *z*-score, you can compute the probability-----FALSE

$$z_i = \frac{X_i - \overline{X}}{s}$$



CHAPTER 7: DISTRIBUTION OF THE SAMPLE MEANS

1. Define distribution of sampling means
2. Describe distribution by shape, expected value, and standard error
3. Describe location of sample mean *M* by z-score
4. Determine probabilities corresponding to sample mean using z-scores, unit normal table

Sampling error - the natural discrepancy, or the amount of error, between a sample statistic and its corresponding population parameter.

- Samples are **variable**; no two samples are identical.
- Error does **not** indicate a mistake was made.
- The variability of sampling error is measured by the **standard error**

Distribution of sample means OR **sampling distribution** - the collection of sample means for all the possible random samples of a particular size (*n*) that can be obtained from a population

- A theoretical probability distribution: X-axis: sample means & Y-axis: probabilities
- Subject to all principles for a probability distribution
  -Mean and variance
  -Calculate the probability of getting a certain sample mean (inferential statistics)
- A distribution of statistics obtained by selecting **all the possible samples** of a specific size (*n*) from a population
- The sample means pile up around the population mean.
- The distribution of sample means is approximately normal in shape

CENTRAL LIMIT THEOREM:

1. Applies to *any population* with mean μ and standard deviation σ
2. Distribution of sample means approaches a normal distribution as *n* approaches infinity
3. Distribution of sample means for samples of size *n* will have a mean of μ
4. Distribution of sample means for samples of size *n* will have a standard deviation $\sigma / \sqrt{n}$

$$\sigma_x = \frac{\sigma}{\sqrt{n}}$$

$x \sim (u, s^2)$ $\quad$ $\overline{x} \sim (u, s^2 / n)$

standard deviation OR *standard error* of the sample means
(measures variability of sample means)

Distribution of the sample means is almost perfectly normal IF….

1. The population from which the samples are selected is a normal distribution ***or***
2. The number of scores (n) in each sample is relatively large, around 30 or more.

Law of large numbers: the larger the sample size, the more probable it is that the sample mean will be close to the population mean.

Population variance: The greater the variance in the population, the less probable it is that the sample mean will be close to the population mean.

1) A population has $\mu = 60$ with $\sigma = 5$. The distribution of sample means for samples of size $n = 4$ selected from this population would have an expected value of ______. **60**

2) The distribution of sample means is always normal shaped-----FALSE (**$n \geq 30$**)

3) As sample size increases, the value of the standard error decreases-----TRUE

4) A random sample of $n = 16$ scores is obtained from a population with $\mu = 50$ and $\sigma = 16$. If the sample mean is $M = 58$, what is the z-score corresponding to the sample mean?
z = 2.00

5) A sample mean with $z = 3.00$ is a fairly typical, representative sample-----FALSE (extreme)

6) The mean of the sample is always equal to the population mean-----FALSE

GOOD JOB – ZAC ☺

SUMMARY

- Sampling distribution of a statistic can be considered as the distribution of the statistic for *all possible random samples* of a given size
- It has a mean and a standard deviation (standard error), and probability can be calculated
- CLT states the relationship between population and the sampling distribution of the means based on that population
- Sampling distribution is the basis for inferential statistics and hypothesis testing