TESTS – I

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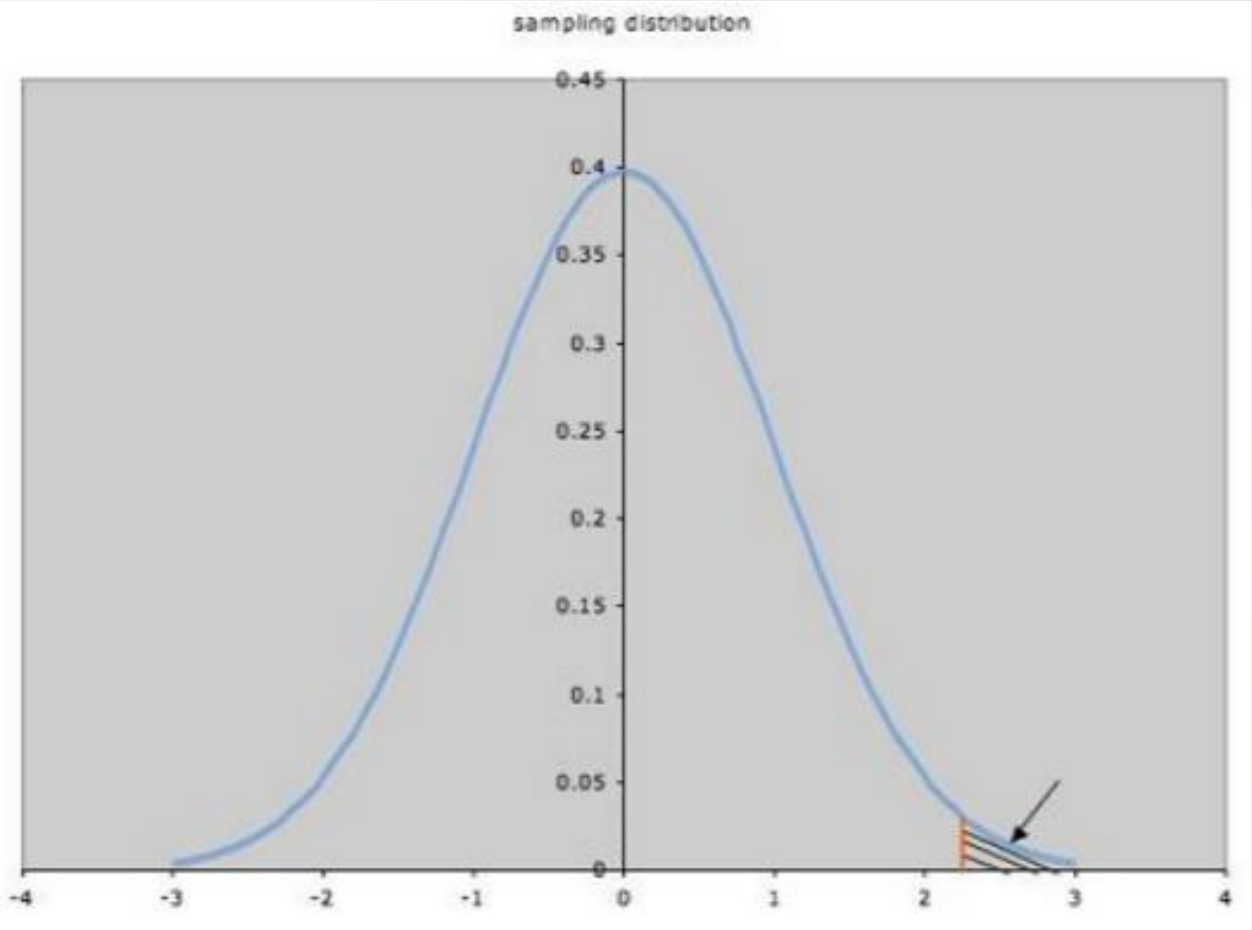
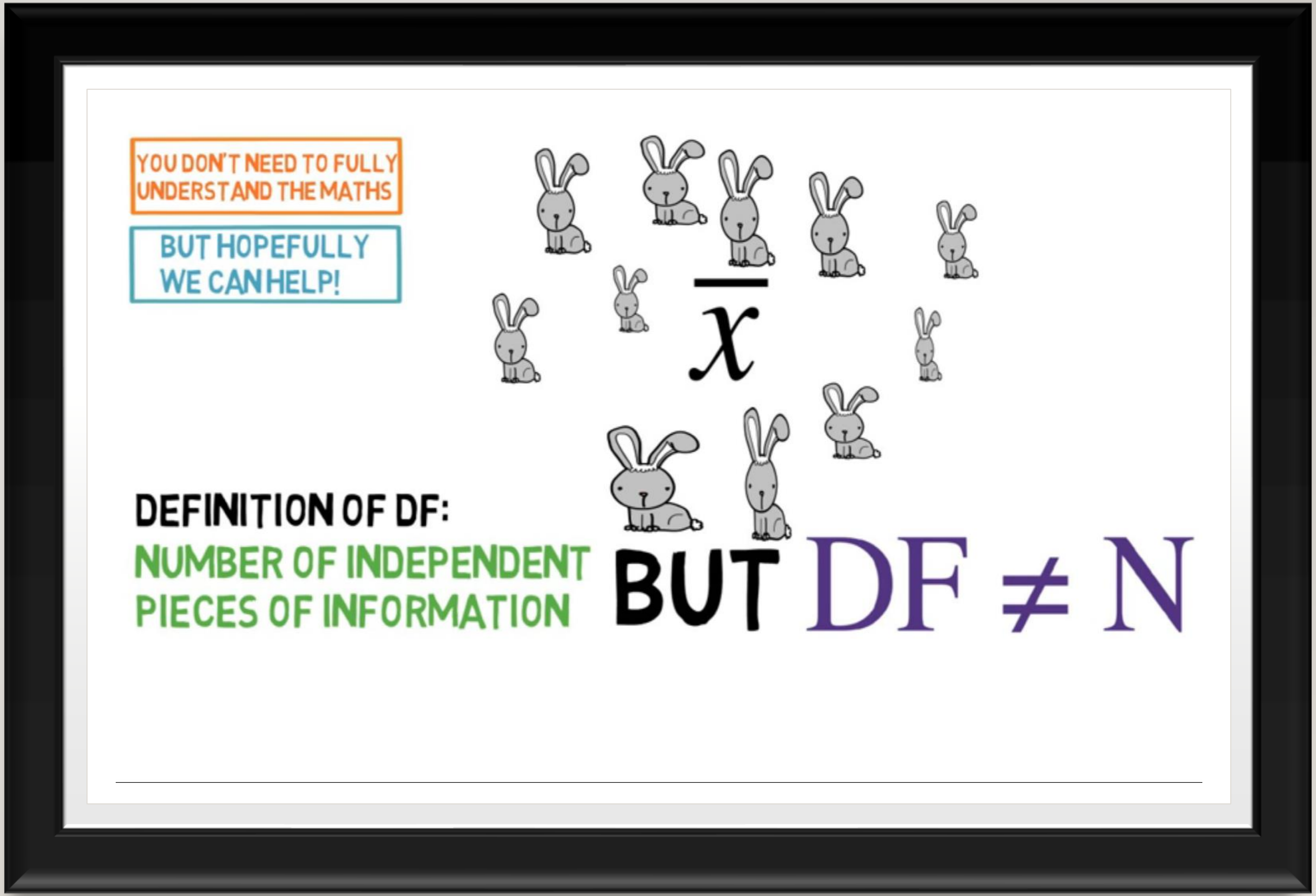
CRITICAL VALUE

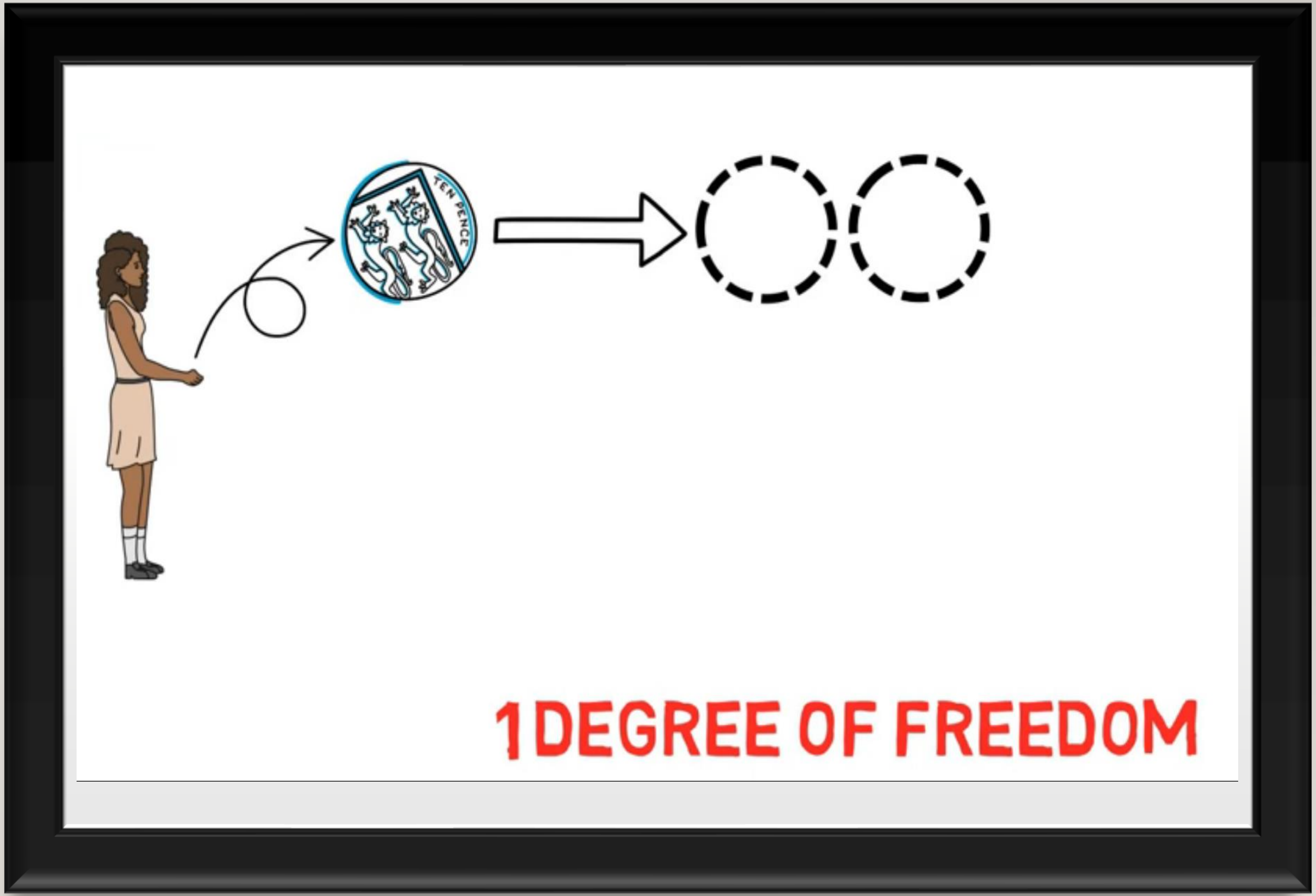
A CRITICAL VALUE IS A LINE ON A GRAPH THAT SPLITS THE GRAPH INTO SECTIONS.



DEGREES OF FREEDOM



EXAMPLE FOR DEGREES OF FREEDOM



HYPOTHESIS TESTING STEPS

1. State the Null Hypothesis (H0) and Alternate Hypothesis (H1)
2. Choose the Level of Significance
3. Find Critical Values
4. Find test Statistic
5. Draw your conclusion

ONE VARIABLE - TESTS

z
t

Closely related to Sampling Distribution of **Means**

χ^2 (Chi-squared)
F

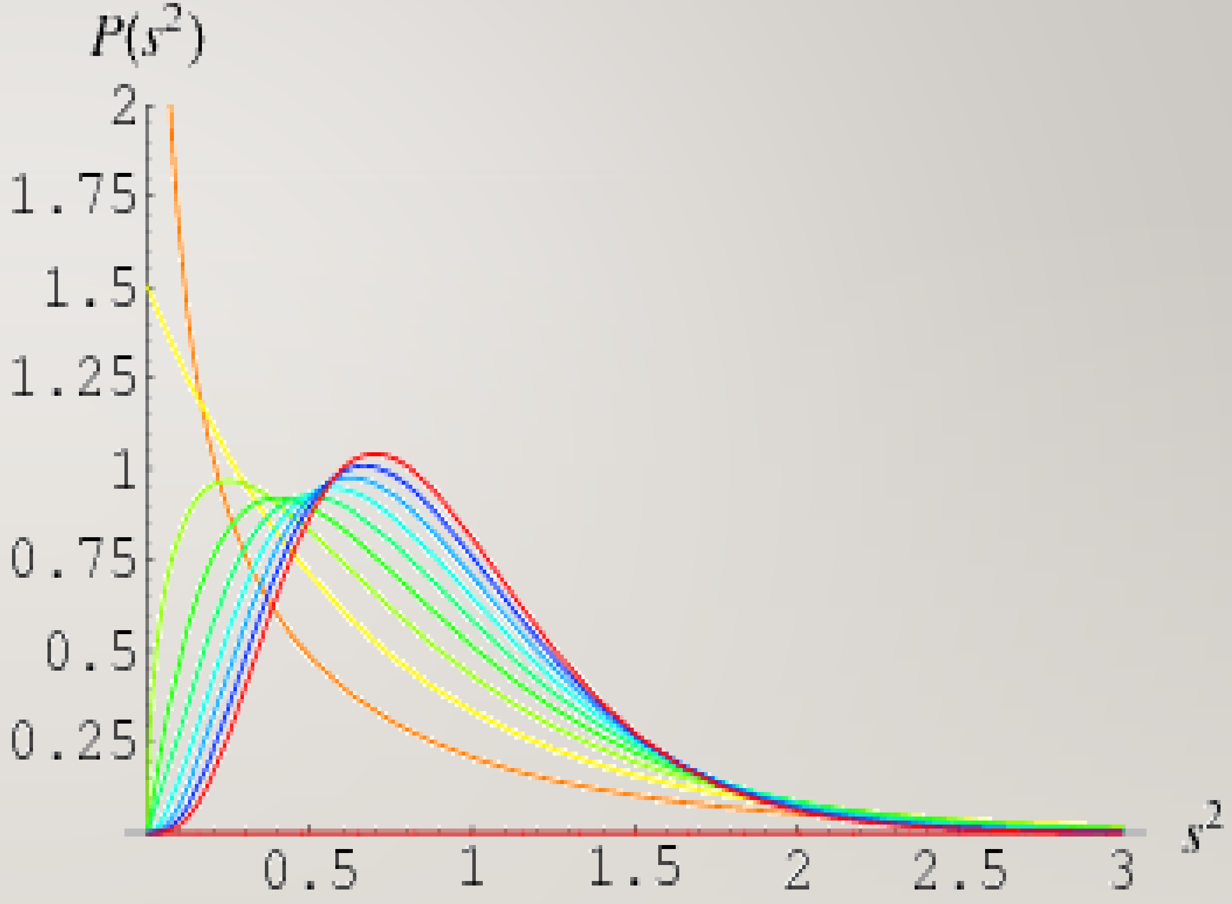
- Closely related to Sampling Distribution of **Variances**
- Derived from Normal Distribution

WHAT ARE THEY

- Normality: tests for normal distribution in a population sample.
- T-test: tests for a Student's t-distribution – ie, in a normally distributed population where standard deviation in unknown and sample size is comparatively small. Paired t-tests compare two samples.
- Chi-Square Test for Independence: tests for an association of significance between two categorical variables in a population sample. Typically used with random sampling.
- Analysis of Variance (ANOVA): tests for and analyzes differences between the means in several groups. Often used similarly to a t-test, but for more than two groups.

SAMPLING DISTRIBUTION OF VARIANCE

THE DISTRIBUTION OF SAMPLE VARIANCES, WITH ALL HAVING THE SAME SAMPLE SIZE N



Z – TEST

- A **z-test** is a **statistical test** used to determine whether means are different when the variance of population known and the sample size is large.

ASSUMPTIONS FOR Z – TEST

The sample size is large (n > 30)

The data were collected in a random way, each observation must be independent of the others

the sampling distribution must be normal or approximately normal, and the population standard deviation must be known

EXAMPLE FOR Z – TEST

- A principal at a certain school claims that the students in his school are above average intelligence. A random sample of thirty students IQ scores have a mean score of 112. Is there sufficient evidence to support the principal's claim? The mean population IQ is 100 with a standard deviation of 15.

STUDENT'S T-DISTRIBUTION

Developed by William Sealy Gossett while he was working at Guinness Brewery

GOAL OF STUDENT'S T-DISTRIBUTION

- Goal was to select the best barley from small samples

PURPOSE OF T-TEST

- Using the t-table, the Student's t-test determines if there is a significant difference in means between two sets of data

ASSUMPTIONS FOR T – TEST

The sample size is not large (n < 30)

The data were collected in a random way, each observation must be independent of the others,

The sampling distribution must be normal

ONE SAMPLE T- TEST CALCULATION

- The t-statistic:

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$\bar{x}$ = sample mean
μ = population mean
s = sample standard error
n = sample size

GUESS WHAT THE DEGREE OF FREEDOM IS FOR T –TEST!

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- Degrees of Freedom df = N-1

EXAMPLE FOR T – TEST

- A car company claims that their Super Spiffy Sedan averages 31 mpg. You randomly select 8 Super Spiffies from local car dealerships and test their gas mileage under similar conditions.
- You get the following MPG scores:
- MPG: 30 28 32 26 33 25 28 30
- Does the actual gas mileage for these cars deviate significantly from 31 (alpha = .05)?

EXAMPLE FOR T – TEST

- Your company wants to improve sales. Past sales data indicate that the average sale was \$100 per transaction. After training your sales force, recent sales data (taken from a sample of 25 salesmen) indicates an average sale of \$130, with a standard deviation of \$15. Did the training work? Test your hypothesis at a 5% alpha level.

X^2 TEST (CHI SQUARE TEST)

THE CHI SQUARE STATISTIC IS COMMONLY USED FOR TESTING RELATIONSHIPS BETWEEN CATEGORICAL VARIABLES.

GOODNESS OF FIT

Set up the hypothesis for Chi-Square goodness of fit test:

Null hypothesis: In Chi-Square goodness of fit test, the null hypothesis assumes that there is no significant difference between the observed and the expected value.

Alternative hypothesis: In Chi-Square goodness of fit test, the alternative hypothesis assumes that there is a significant difference between the observed and the expected value.

FORMULA FOR GOODNESS OF FIT

And fail to reject the null hypothesis if our test statistic > Chi square value

$$\chi^2 = \sum(O - E)^2 / E$$

Here

O – stands for observed value and

E – Stands for expected value

CHI – SQUARE TABLE

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	**0.95**	**0.90**	**0.75**	**0.50**	**0.25**	**0.10**	**0.05**	**0.01**
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21

EXAMPLE FOR CHI SQUARE TEST

Day	Monday	Tuesday	Wed	Thu	Fri	Sat
Expected %	10	10	15	20	30	15
Observed	30	14	34	45	57	20