Determine what test to use then write the null, alternative hypothesis and claim in symbolic form.

1) A study was conducted to determine if the salaries of librarians from two neighboring states were equal. A sample of 100 librarians from each state was randomly selected. The mean from the first state was $29,100 with a standard deviation of $2300. The mean from the second state was $30,500 with a standard deviation of $2100. Test the hypothesis that there is no difference in salaries from both states. Use $\alpha = 0.05$.

2) At a retail store, 61 female employees were randomly selected and it was found that their monthly income had a standard deviation of $255.15. For 121 male employees, the standard deviation was $354.27. Test the hypothesis that variance of monthly incomes is different for male employees than it is for female employees. Use $\alpha = 0.01$. Assume the samples were randomly selected from normal populations.

3) A football coach claims that players can increase their strength by taking a certain supplement. To test the theory, the coach randomly selects 9 athletes and gives them a strength test using a bench press. The results are listed below. Thirty days later, after regular training using the supplement, they are tested again. The new results are listed below. Test the claim that the supplement is effective in increasing the athletes' strength. Use $\alpha = 0.05$. Assume that the distribution is normally distributed.

Athlete	1	2	3	4	5	6	7	8	9
Before	215	240	188	212	275	260	225	200	185
After	225	245	188	210	282	275	230	195	190

4) A sports statistician is interested in determining if there is a relationship between the number of home team and visiting team losses and different sports. A random sample of 526 games is selected and the results are given below. Test the claim that the number of home team and visiting team losses is independent of the sport. Use $\alpha = 0.01$.

	Football	Basketball	Soccer	Baseball
Home team losses	39	156	25	83
Visiting team losses	31	98	19	75

5) A teacher figures that final grades in the chemistry department are distributed as: A, 25%; B, 25%; C, 40%; D, 5%; F, 5%. At the end of a randomly selected semester, the following number of grades were recorded. Find the P–value to determine if the grade distribution for the department is different than expected. Use $\alpha = 0.01$.

Grade	A	B	C	D	F
Number	42	36	60	14	8

6) A recent survey showed that in a sample of 100 elementary school teachers, 15 were single. In a sample of 180 high school teachers, 36 were single. Is the proportion of high school teachers who were single greater than the proportion of elementary teachers who were single? Use $\alpha = 0.01$.

7) Four different types of insecticides are used on strawberry plants. The number of strawberries on each randomly selected plant is given below. Test the hypothesis that the type of insecticide makes no difference in the mean number of strawberries per plant. Use $\alpha = 0.01$.

Insecticide 1	Insecticide 2	Insecticide 3	Insecticide 4
6	5	6	3
7	8	3	5
6	5	2	3
5	5	3	4
7	5	4	5
4	6	3	6

Write your final conclusion "STEP4" (no need to do any calculations all the information you need is given).

8) A random sample of size n = 50 results in a sample mean of 24 and a sample standard deviation of 1.5. An independent sample of size n = 60 results in a sample mean of 22 and a sample standard deviation of 1.9. Does this constitute sufficient evidence to conclude that the population means differ at the $\alpha = 0.05$ level of significance? Assume you already ran the calculations C.V. Z = 1.96 and T.S. Z=6.17.

9) In a survey, 78 of 180 women said that they regularly remember their dreams, while 70 of 171 men said that they regularly remember their dreams. Does this constitute sufficient evidence to conclude that women are more likely to remember their dreams than men? Use the $\alpha = 0.05$ level of significance. Assume you calculated your p–value to be greater than alpha.

10) The contingency table below shows the results of a random sample of 200 registered voters that was conducted to see whether their opinions on a bill are related to their party affiliation.

Party	Opinion		
	Approve	Disapprove	No Opinion
Republican	42	20	14
Democrat	50	24	18
Independent	10	16	6

Test the claim of independence. Use $\alpha = 0.05$. Assume test statistic $X^2 = 8.030$ and critical value $X^2 = 12.59$

11) The grade point averages of students participating in sports at a local college are to be compared. The data are listed below. Test the hypothesis that there is no difference in the mean grade point averages of the 3 groups. Use $\alpha = 0.05$. Assume that alpha < p–value.

Hockey	Track	Basketball
3.2	1.8	3.0
2.1	1.9	2.7
2.5	2.1	2.8
3.5	3.3	2.5
3.1		2.5
2.6		

12) A local company is concerned about the number of days missed by its employees due to illness. A random sample of 10 employees is selected. The number of days absent in one year is listed below. An incentive program is offered in an attempt to decrease the number of days absent. The number of days absent in one year after the incentive program is listed below. Test the claim that the incentive program cuts down on the number of days missed by employees. Use $\alpha = 0.05$. Assume that the distribution is normally distributed and 0.005 < P–value

Employee	A	B	C	D	E	F	G	H	I	J
Days absent before	3	8	7	2	9	4	2	0	7	5
Days absent after	1	7	7	0	8	2	0	1	5	5

Construct a C.I. and interpret results.

13) Construct a 95% confidence interval for $p_m - p_f$ for a survey that finds 30% of 240 males and 41% of 200 females are opposed to the death penalty. Then interpret the results.

14) A study was conducted to determine if the salaries of librarians from two neighboring cities were equal. A sample of 15 librarians from each city was randomly selected. The mean from the first city was \$28,900 with a standard deviation of \$2300. The mean from the second city was \$30,300 with a standard deviation of \$2100. Construct a 95% confidence interval for $\mu_1 - \mu_2$. Then interpret the results.

Conduct a 4 step Hypotesis test. There is one of each test we covered 7 total.
(I will write up complete solutions on review day for now try it on your own)

15) In a recent survey of drinking laws, a random sample of 1000 women showed that 65% were in favor of increasing the legal drinking age. In a random sample of 1000 men, 60% favored increasing the legal drinking age. Test the hypothesis that the percentage of men and women favoring a higher legal drinking age is the same. Use $\alpha = 0.05$.

16) A physician claims that a person's diastolic blood pressure can be lowered if, instead of taking a drug, the person meditates each evening. Ten subjects are randomly selected and pretested. Their blood pressures, measured in millimeters of mercury, are listed below. The 10 patients are instructed in basic meditation and told to practice it each evening for one month. At the end of the month, their blood pressures are taken again. The data are listed below. Test the physician's claim. Use $\alpha = 0.01$.

Patient	1	2	3	4	5	6	7	8	9	10
Before	85	96	92	83	80	91	79	98	93	96
After	82	90	92	75	74	80	82	88	89	80

17) A university wanted to see whether there was a significant difference in age between its day staff and evening staff. A random sample of 35 staff members is selected from each group. The data are given below. Test the hypothesis that there is no difference in age between the two groups. Use $\alpha = 0.05$.

Day Staff

22	24	24	23	19	19	23	22	18	21	21	18
18	25	29	24	23	22	22	21	20	20	20	27
17	19	18	21	20	23	26	30	25	21	25	

Evening Staff

18	23	25	23	21	21	23	24	27	31	24	20
20	23	19	25	24	27	23	20	20	21	25	24
23	28	20	19	23	24	20	27	21	29	30	

18) A medical researcher suspects that the variance of the pulse rate of drinkers is higher than the variance of the pulse rate of non-drinkers. Use the sample statistics below to test the researcher's suspicion. Use $\alpha = 0.05$.

Drinkers	Non-drinkers
$n_1 = 61$	$n_2 = 121$
$s_1 = 9.36$	$s_2 = 6.36$

Assume the samples were randomly selected from normal populations.

Conduct a 4 step Hypotesis test.

19) A random sample of 160 car purchases are selected and categorized by age. The results are listed below. The age distribution of drivers for the given categories is 18% for the under 26 group, 39% for the 26–45 group, 31% for the 46–65 group, and 12% for the group over 65. Test the claim that all ages have purchase rates proportional to their driving rates. Use $\alpha = 0.05$.

Age	Under 26	26 – 45	46 – 65	Over 65
Purchases	66	39	25	30

20) A random sample of 400 men and 400 women was randomly selected and asked whether they planned to attend a concert in the next month. The results are listed below. Perform a homogeneity of proportions test to test the claim that the proportion of men who plan to attend a concert in the next month is the same as the proportion of women who plan to attend a concert in the next month. Use $\alpha = 0.05$.

	Men	Women
Plan to attend concert	230	255
Don't plan to attend concert	170	145

21) The times (in minutes) to assemble a component for 3 different cell phones are listed below. Workers are randomly selected. Test the hypothesis that there is no difference in the mean time for each cell phone. Use $\alpha = 0.01$.

Phone 1	Phone 2	Phone 3
32	40	28
31	29	25
30	38	29
32	33	31
33	36	
31	35	
	32	

1) 2sampleTtest
   Ho: $\mu_1 = \mu_2$ (claim)
   H1: $\mu_1 \neq \mu_2$
2) 2sampleFtest
   Ho: $\sigma^2_1 = \sigma^2_2$
   H1: $\sigma^2_1 \neq \sigma^2_2$ (claim)
3) T–test (2 sample depedent)
   Ho: $\mu_d = 0$
   H1: $\mu_d < 0$ (claim)
4) X^2 test
   Ho: the number of home team and visiting team losses and different sports are independent (claim)
   H1: the number of home team and visiting team losses and different sports are dependent
5) X^2–GOF–test
   Ho: $p_1 = p_2 = p_3 = p_4 = p_5$ (claim)
   H1: at least one population proportion is different
6) 2propZtest
   Ho: $p_1 = p_2$
   H1: $p_1 < p_2$ (claim)
7) ANOVA
   Ho: $\mu_1 = \mu_2 = \mu_3 = \mu_4$ (claim)
   H1: at least one population mean is different
8) Reject H_0. There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that there is a difference in the population means.
9) Do not reject H_0. At the 5% significance level, there is not sufficient evidence to support the claim that women are more likely to remember their dreams than men.
10) fail to reject H_0; There is not sufficient evidence to reject the claim of independence. (or you can say: opinions on a bill and political party are not related)
11) fail to reject H_0; The data does not provide enough evidence to indicate that the mean grade point avergae of the 3 sports are unequal.
    (or same as saying: there is NOT sufficient evidence to REJECT the claim that ...)
12) (just for practice --> claim: $\mu_d > 0$)
    reject H_0; There is sufficient evidence to support the claim that the incentive program cuts down on the number of days missed by employees.
13) 2propZ–Interval: (–0.200, –0.021)
    since interval is negative this implies $p_m < p_f$
    so it suggest females are more opposed the death penalty than males.
14) 2sample T –Interval: (–3125, 325)
    since interval contains zero this implies $\mu_1 = \mu_2$
    so it suggest salaries of librarians from both cities are equal
15) $\alpha = 0.05$: $p_1 = p_2$; critical value $z_0 = 1.96$; test statistic $t \approx 2.309$; reject the null hypothesis; There is sufficient evidence to reject the hypothesis.

16) claim: $\mu_d > 0$; critical value $t_0 = 2.821$; test statistic $t \approx 3.490$; reject H_0; There is sufficient evidence to support the claim.

17) day staff $\overline{x_1} = 22$, $s_1 = 3.13$; evening staff $\overline{x_2} = 23.29$, $s_2 = 3.27$;
critical values $t_0 = \pm 1.96$; test statistic $t = -1.69$; fail to reject H_0; There is not sufficient evidence to reject the hypothesis.

18) p–value= .0002; test statistic $F \approx 2.166$; reject H_0; There is sufficient evidence to support the hypothesis.

19) critical value $\chi^2_\alpha = 7.815$; chi–square test statistic $\chi^2_0 = 75.101$; reject H_0; There is sufficient evidence to reject the claim that all ages have the same purchase rate.

20) critical value $\chi^2_\alpha = 3.841$; chi–square test statistic $\chi^2_0 = 3.273$; fail to reject H_0; There is not sufficient evidence to reject the claim.

21) p–value=.0074; test statistic $F \approx 7.103$; reject H_0; There is enough evidence that the sample means are different.