

**Example 1 (Testing Goodness of Fit of a Discrete Distribution):**

The results of 180 rolls of a die are given below:

X	Ox
1	28
2	36
3	36
4	30
5	27
6	23
TOTAL	180

Test if the die is fair.

Null hypothesis to be tested is

$$H_0: P(X=x) = 1/6 \text{ for } x = 1, 2, \dots, 6$$

Open the data file DIE.xlsx in MINITAB, and click on:

Stat/Tables/Chi-Square Goodness of Fit Test (One Variable) - see Figure 1a, which will open the window in Figure 1b; select Observed Counts, and graphs (see Figure 1b).

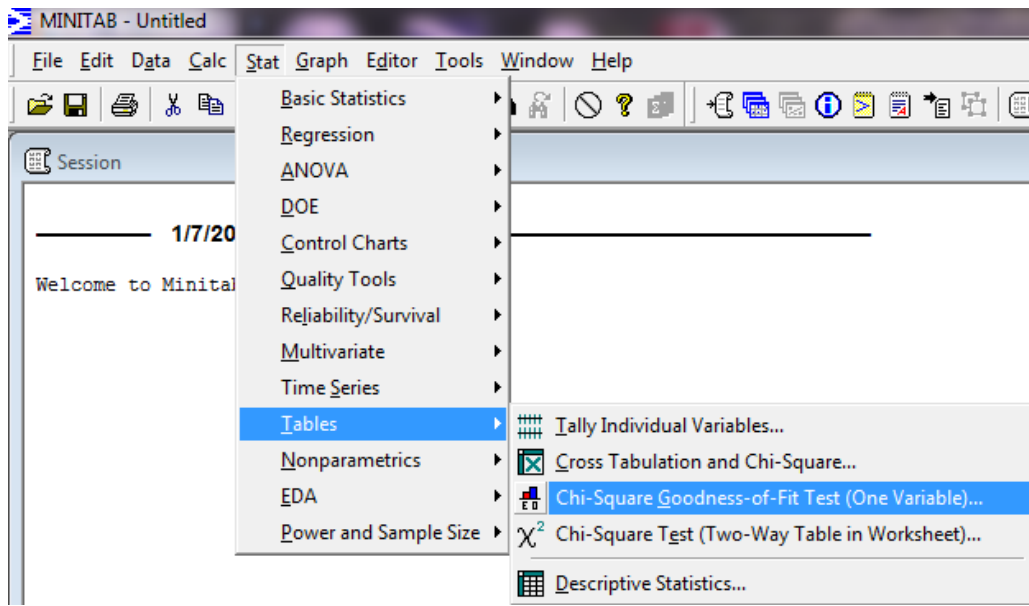


Figure 1a: Running the Chi-Square Goodness of Fit Test in MINITAB

# Chi-square Tests in MINITAB

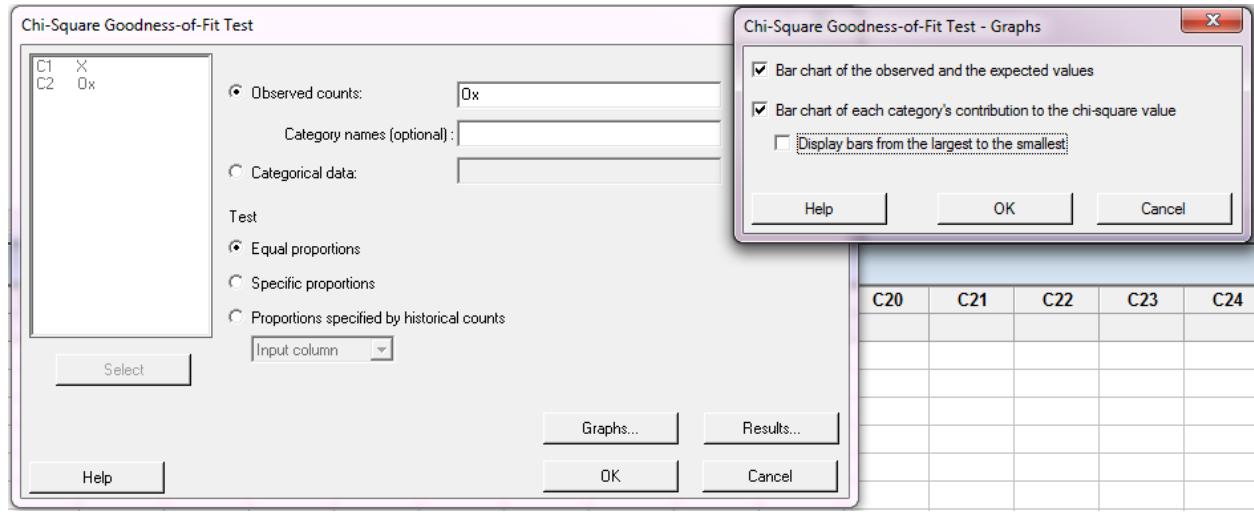


Figure 1b: Selecting Observed and Graphs

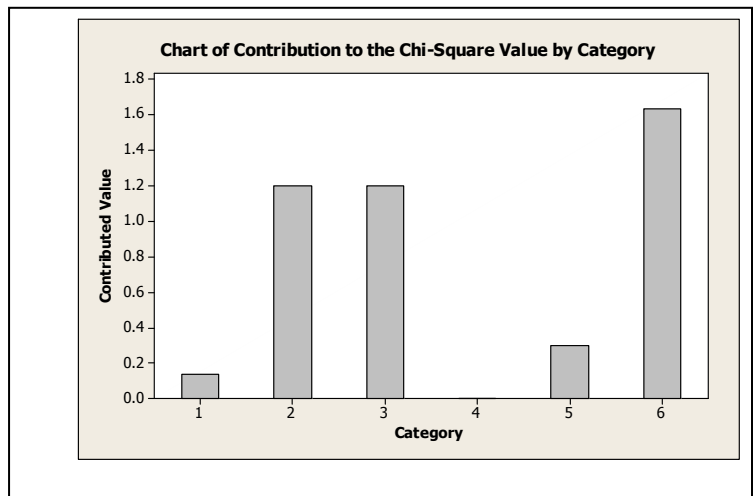
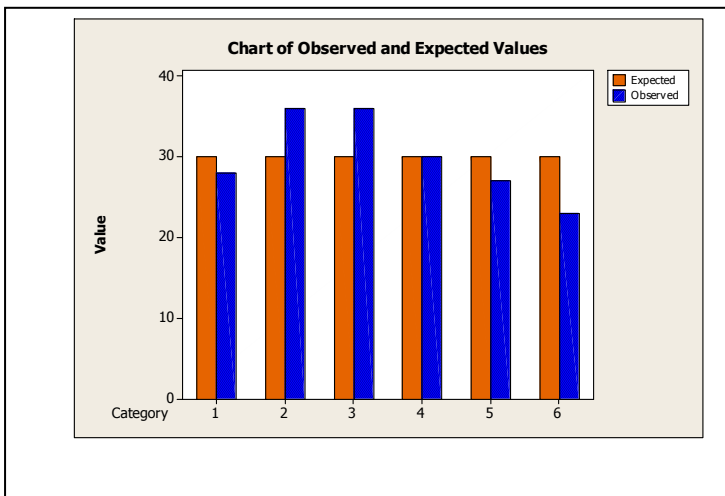
Click OK to get the following output and graphs:

## Chi-Square Goodness-of-Fit Test for Observed Counts in Variable: Ox

Category	Observed	Test Proportion	Expected	Contribution to Chi-Sq
1	28	0.166667	30	0.13333
2	36	0.166667	30	1.20000
3	36	0.166667	30	1.20000
4	30	0.166667	30	0.00000
5	27	0.166667	30	0.30000
6	23	0.166667	30	1.63333

N	DF	Chi-Sq	P-Value
180	5	4.46667	0.484

Since  $P\text{-value} = .484 > .05$ , the null hypothesis of fair die is not rejected.



## Chi-square Tests in MINITAB

### **Example 2 (Testing Independence):**

Given the following data, test if Voting Preference is independent of Gender (see worksheet Independence of the file [chi-square tests in excel.xlsx](#)).

GENDER	Voting Preferences			Row total
	Republican	Democrat	Independent	
Male	300	150	50	500
Female	250	300	50	600
Column total	550	450	100	1100

Type the data in MINITAB as shown in Figure 2b, then click on:

Stat/Tables/Chi-Square Test (Two-Way Table in Worksheet), which will open the window of Figure 2b; select Republican, Democrat, Independent columns containing the table.

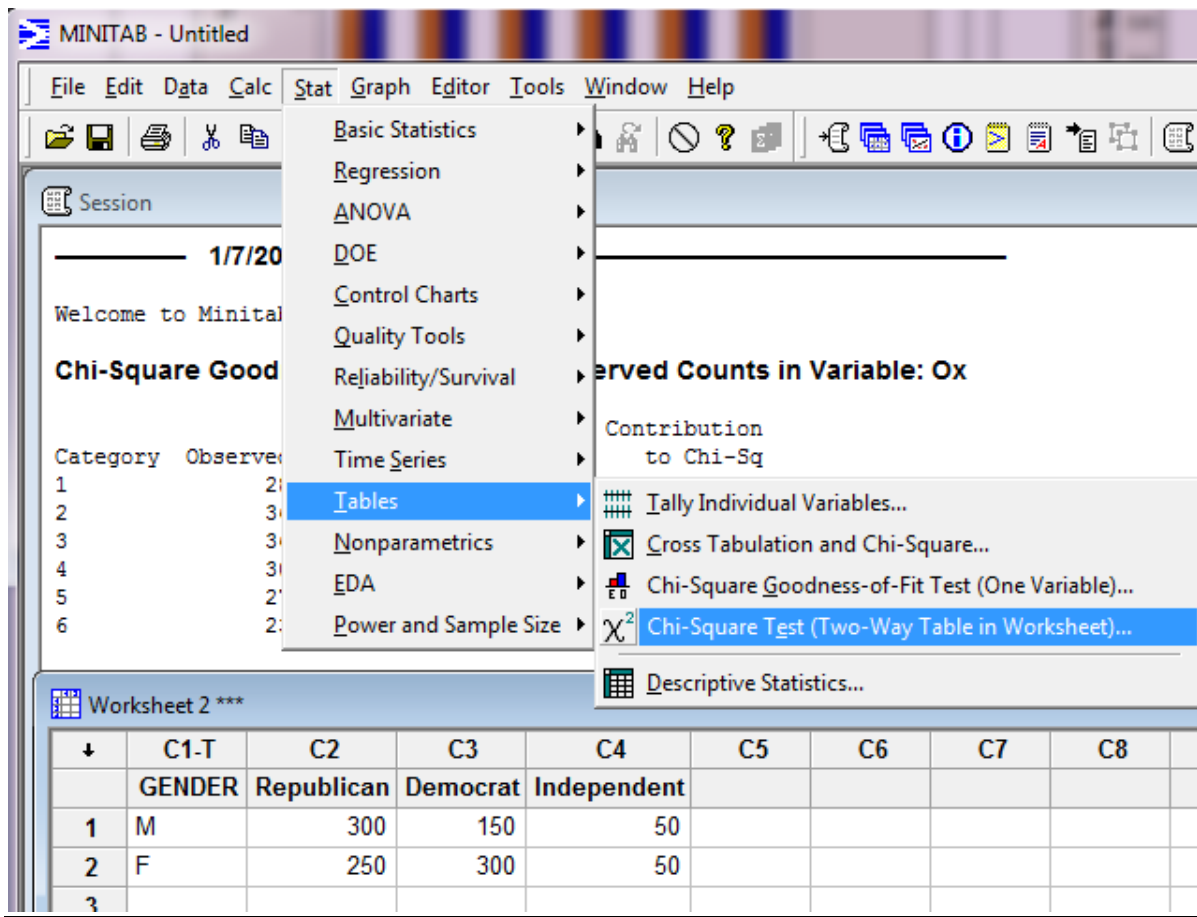
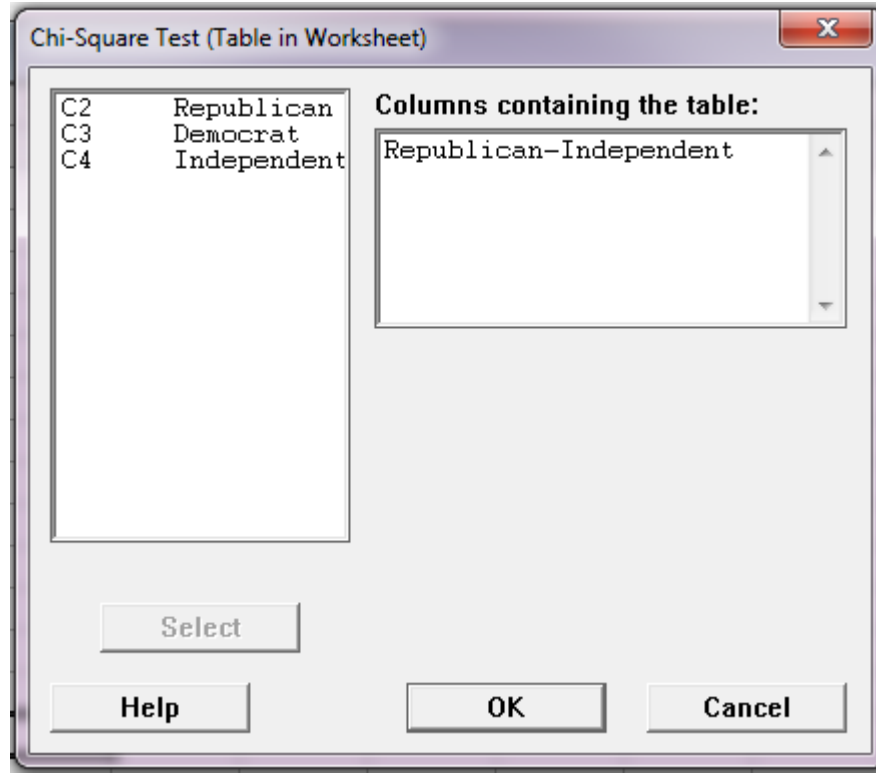


Figure 2a: Running Chi-Square Test of Independence in MINITAB

## Chi-square Tests in MINITAB



The output from MINITAB is shown below:

### Chi-Square Test: Republican, Democrat, Independent

Expected counts are printed below observed counts  
Chi-Square contributions are printed below expected counts

	Republican	Democrat	Independent	Total
1	300	150	50	500
	250.00	204.55	45.45	
	10.000	14.545	0.455	
2	250	300	50	600
	300.00	245.45	54.55	
	8.333	12.121	0.379	
Total	550	450	100	1100

Chi-Sq = 45.833, DF = 2, P-Value = 0.000

The null hypothesis being tested is:  
 $H_0$ : Voting Preference and Gender are independent

Since P-value = .000 < .05, the null hypothesis of independence is rejected.

**Example 3 (Testing Homogeneity of Proportions):**

In a telephone survey, respondents were asked to indicate their level of agreement with the statement “Cigarette smoking should be banned in public places”. The results are shown in the table below: SA = strongly agree, A = agree, N = neutral, D = disagree, SD = strongly disagree. Test if there is no difference in Males and Females with respect to their level of agreement on the banning of smoking in public places.

Gender	SA	A	N	D	SD	TOTAL
F	40	38	16	37	5	136
M	16	25	11	25	11	88
TOTAL	56	63	27	62	16	224

(see worksheet Homogeneity of the file [chi-square tests in excel.xlsx](#)).

The null hypothesis  $H_0$ : there is no difference in Males and Females with respect to their level of agreement on the banning of smoking in public places.

The Chi-Square Test of Homogeneity is run in exactly the same as a Goodness of Fit Test (see Example 2 above). Type data in MINITAB and then click on

Stat/Tables/Chi-Square Test (Two-Way Table in Worksheet), which will open the Chi-Square Test window (see Figure 3); select the columns SA, A, N, D, SD and click OK to get the output of the Chi-Square Test shown on the following page.

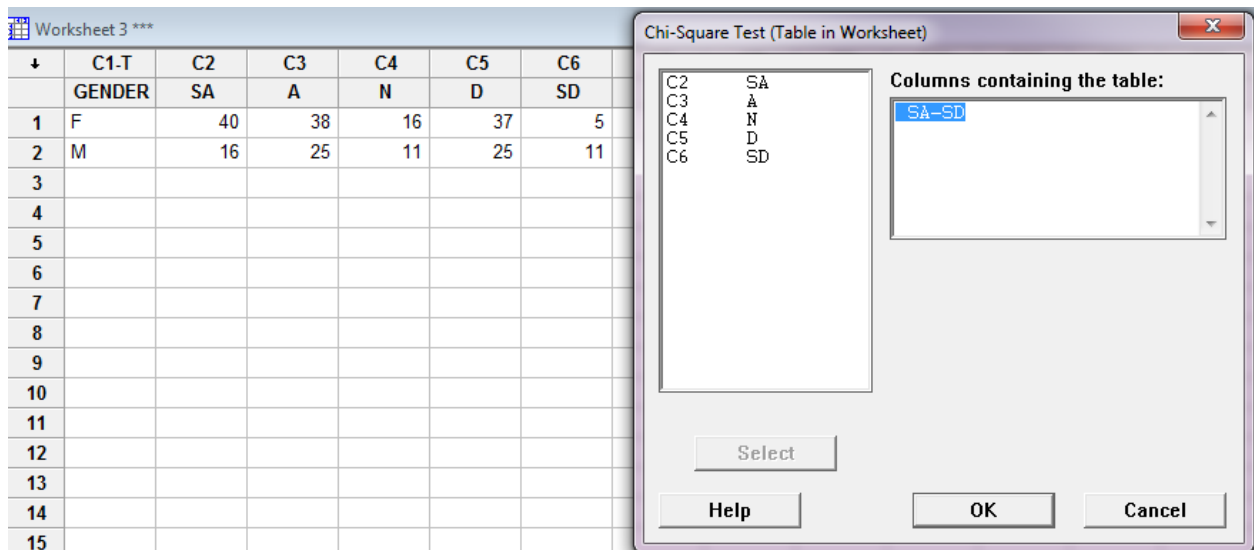


Figure 3: Running the Chi-Square Test of Homogeneity in MINITAB

## Chi-square Tests in MINITAB

### Chi-Square Test: SA, A, N, D, SD

Expected counts are printed below observed counts  
Chi-Square contributions are printed below expected counts

	SA	A	N	D	SD	Total
1	40	38	16	37	5	136
	34.00	38.25	16.39	37.64	9.71	
	1.059	0.002	0.009	0.011	2.288	
2	16	25	11	25	11	88
	22.00	24.75	10.61	24.36	6.29	
	1.636	0.003	0.015	0.017	3.536	
Total	56	63	27	62	16	224

Chi-Sq = 8.575, DF = 4, P-Value = 0.073

The null hypothesis being tested is:

$H_0$ : there is no difference in Males and Females with respect to their level of agreement on the banning of smoking in public places

Since P-value = .073 > .05, the null hypothesis of homogeneity is not rejected.