## **Goodness of Fit Worksheet Solutions**

**Discrete Random Variables** 

**Police Calls-** The Eastland Police Department released the following numbers for calls for different days in a week.

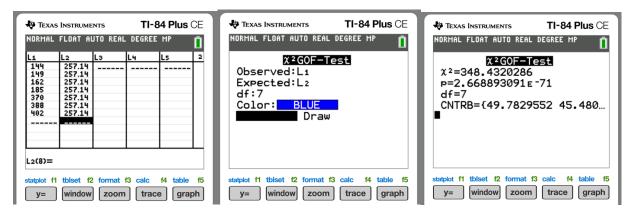
1. Use the 1% level of significance to test the claim that the different number of calls have the same frequency.

x	0
Monday	144
Tuesday	149
Wednesday	162
Thursday	185
Friday	370
Saturday	388
Sunday	402
Total	1800

 $H_0: p_1 = p_2 = p_3 = p_4 = p_5 = p_6 = p_7 = \frac{1}{7}$  Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

$$E = np_i = 1800 \cdot \frac{1}{7} \approx 257.143$$

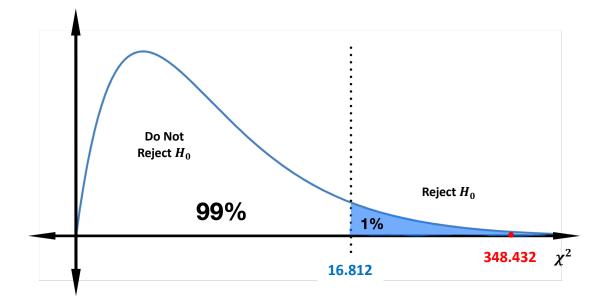


 $p \approx 0.000; p < \alpha; p$  value is low,  $H_0$  has to go! The Sample Does Not Support the Claim The distribution is not as claimed

х	0	E	О-Е	(O-E)^2	(O-E)^2/E
Monday	144	257.143	-113.143	12801.338	49.783
Tuesday	149	257.143	-108.143	11694.908	45.480
Wednesday	162	257.143	-95.143	9052.190	35.203
Thursday	185	257.143	-72.143	5204.612	20.240
Friday	370	257.143	112.857	12736.702	49.532
Saturday	388	257.143	130.857	17123.554	66.592
Sunday	402	257.143	144.857	20983.550	81.603
Total	1800				348.432

## $\chi^2 \approx 348.432$

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$					Are	Right of the	e Critical V	alue			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$											
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1	_	_	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$											18.548
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$											23.589
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											26.757
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											28.299
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$											29.819
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	14										31.319
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											34.267
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											35.718
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$											37.156
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$											38.582
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		8.034		10.283	11.591				35.479	38.932	41.401
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		8.643				14.042			36.781	40.289	42.796
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
28         12.461         13.565         15.308         16.928         18.939         37.916         41.337         44.461         48.275         50.           29         13.121         14.257         16.047         17.708         19.768         39.087         42.557         45.722         49.588         53.3           30         13.787         14.954         16.791         18.493         20.599         40.256         43.773         46.979         50.892         53.3           40         20.707         22.164         24.433         26.509         20.051         51.805         55.758         59.342         63.016         66.           50         27.991         29.707         32.357         34.764         37.689         63.167         67.505         71.420         76.154         79.           60         35.534         37.485         40.482         43.188         46.459         74.397         79.062         83.298         88.379         91.           70         43.275         45.442         48.788         51.739         55.329         85.572         90.531         100.422         104.           80         51.127         55.1369         55.78         10.879											48.290
29         13.121         14.257         16.047         17.708         19.768         39.087         42.557         45.722         49.588         52.           30         13.787         14.954         16.791         18.493         20.599         40.256         43.773         46.979         50.892         53.           40         20.707         22.164         24.433         26.509         29.051         51.805         55.758         59.342         63.691         66.           50         27.991         29.707         32.357         34.764         37.689         63.167         67.505         71.420         76.154         79.992           60         35.534         37.485         40.482         43.188         46.459         74.397         79.082         83.298         83.379         91.           70         43.275         45.442         48.758         51.739         55.297         90.531         95.023         10.0425         10.425         10.425         10.425         10.445         10.487         10.487         10.489         10.488         10.487         10.452         10.448         10.417         11.5329         110.457         10.452         111.3239         110.452         10.445				14.573							49.645
30         13.787         14.954         16.791         18.493         20.599         40.256         43.773         46.979         50.892         53.           40         20.707         22.164         24.433         26.509         29.051         51.805         55.758         59.342         63.616         66.           50         27.991         29.707         32.357         34.764         37.689         63.167         67.905         71.420         76.154         79.           60         35.534         37.485         40.482         43.188         46.459         74.397         79.082         83.298         88.379         91.           70         43.275         45.442         48.788         51.379         55.329         85.572         90.531         90.212         104.           80         51.127         55.450         57.153         60.316         66.75         10.879         106.022         104.											50.993
40         20.707         22.164         24.433         26.509         29.051         51.805         55.758         59.342         63.691         66.6           50         27.991         29.707         32.357         34.764         37.689         63.167         67.505         71.420         76.154         79.           60         35.534         37.485         40.482         43.188         46.459         74.397         79.082         83.298         88.379         91.           70         43.275         45.442         48.758         51.739         55.329         85.527         90.531         95.023         100.425         104.42           80         51.172         55.740         57.153         60.391         64.278         96.578         101.879         106.629         112.329         116.											52.336
50         27.991         29.707         32.357         34.764         37.689         63.167         67.505         71.420         76.154         79.           60         35.534         37.485         40.482         43.188         46.459         74.397         79.082         83.298         88.379         91.           70         43.275         45.442         48.758         51.739         55.329         85.527         90.531         95.023         100.425         104.           80         51.172         53.540         57.153         60.391         64.278         96.578         101.879         106.629         112.329         116.	30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
60         35.534         37.485         40.482         43.188         46.459         74.397         79.082         83.298         88.379         91.179           70         43.275         45.442         48.758         51.739         55.297         95.277         90.531         95.023         100.425         104.425           80         51.172         53.540         57.153         60.391         64.278         96.578         101.879         106.629         112.329         116.											66.766
70         43.275         45.442         48.758         51.739         55.329         85.527         90.531         95.023         100.425         104.           80         51.172         53.540         57.153         60.391         64.278         96.578         101.879         106.629         112.329         116.											79.490
80 51.172 53.540 57.153 60.391 64.278 96.578 101.879 106.629 112.329 116.											91.952
											104.215
											116.321
											128.299 140.169



 $\begin{array}{c} \textbf{Conclusion} \\ \textbf{Reject} \ H_0 \\ \textbf{The distribution is not as claimed} \end{array}$ 

x	0	p(x)
Monday	144	0.1
Tuesday	149	0.1
Wednesday	162	0.1
Thursday	185	0.1
Friday	370	0.2
Saturday	388	0.2
Sunday	402	0.2
Total	1800	

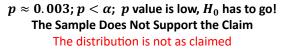
2. Use the **5% level of frequency** to test the claim that the expected proportion described below.

### $H_0: p_1 = 0.1, \ p_2 = 0.1, \ p_3 = 0.1, \ p_4 = 0.1, \ p_5 = 0.2, \ p_6 = 0.2, \ p_7 = 0.2$ Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

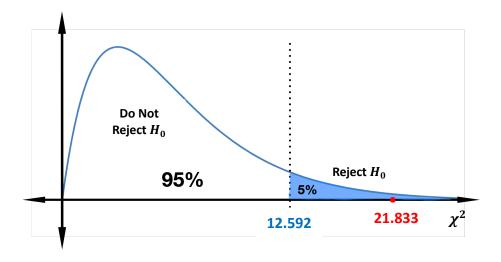
Using the original sample information below we can proceed with  $E = np_i$  for all *i* with n = 1800





х	0	E	О-Е	(O-E)^2	(O-E)^2/E
Monday	144	180	-36	1296.000	7.200
Tuesday	149	180	-31	961.000	5.339
Wednesday	162	180	-18	324.000	1.800
Thursday	185	180	5	25.000	0.139
Friday	370	360	10	100.000	0.278
Saturday	388	360	28	784.000	2.178
Sunday	402	360	42	1764.000	4.900
Total	1800				21.833

				Are	a to the F	Right of the	e Critical V	/alue		
Degrees of										
Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	_	_	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24 25	9.886 10.520	10.856 11.524	12.401 13.120	13.848 14.611	15.659 16.473	33.196 34.382	36.415 37.652	39.364 40.646	42.980 44.314	45.559 46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169



 $\begin{array}{c} \textbf{Conclusion} \\ \textbf{Reject } H_0 \\ \textbf{The distribution is not as claimed} \end{array}$ 

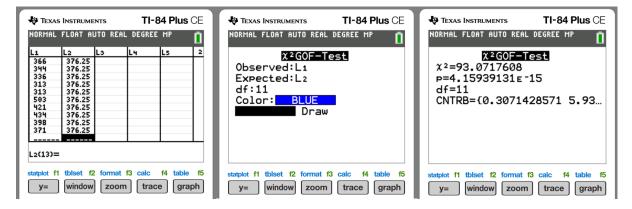
3. **Baseball Player Births**- American born Major League Baseball players have the following frequency counts for the different months of the year. Use the **5% level of significance** to tests the claim that MLB players are born with the same frequency for the different months. **Assume**  $p(x) = \frac{1}{12}$  for all x

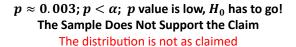
Months	0
January	387
February	329
March	366
April	344
May	336
June	313
July	313
August	503
September	421
October	434
November	398
December	371
Total	4515

$$H_0: p_1 = p_2 = p_3 = p_4 = p_5 = p_6 = p_7 = \frac{1}{12}$$
 Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

$$E = np_i = 4515 \cdot \frac{1}{12} = 376.25$$

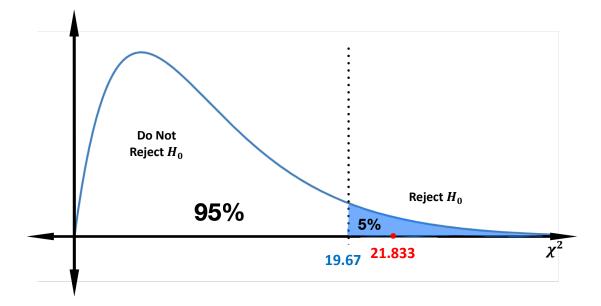


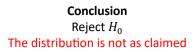


Months	0	E	0-E	(O-E)^2	(O-E)^2?E
January	387	376.25	10.75	115.563	0.307
February	329	376.25	-47.25	2232.563	5.934
March	366	376.25	-10.25	105.063	0.279
April	344	376.25	-32.25	1040.063	2.764
May	336	376.25	-40.25	1620.063	4.306
June	313	376.25	-63.25	4000.563	10.633
July	313	376.25	-63.25	4000.563	10.633
August	503	376.25	126.75	16065.563	42.699
September	421	376.25	44.75	2002.563	5.322
October	434	376.25	57.75	3335.063	8.864
November	398	376.25	21.75	473.063	1.257
December	371	376.25	-5.25	27.563	0.073
Total	4515				93.072

## $\chi^2 \approx 93.072$

		Area to the Right of the Critical Value										
Degrees												
of Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005		
1	_	_	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879		
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597		
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838		
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860		
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750		
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548		
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278		
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955		
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589		
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188		
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757		
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299		
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819		
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319		
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801		
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267		
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718		
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156		
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582		
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997		
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401		
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796		
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181		
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559		
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928		
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290		
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645		
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993		
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336		
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672		
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766		
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490		
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952		
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215		
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321		
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299		
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169		





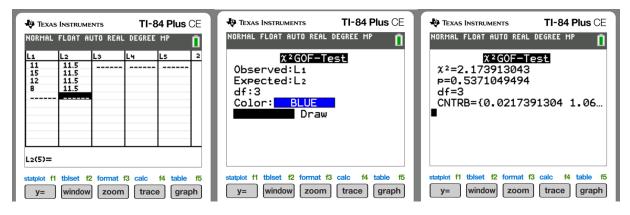
4. Flat Tire and Missed Test- Four carpooling students missed a test and claimed it was due to a flat tire. The instructor separated the students and asked what tire was flat (Left front, left rear, right front, right rear) to determine the consistency of their story and identify the same tire. An instructor ran a blind experiment and asked the class which tire they thought the carpool would select? The following data illustrates the results of the flat tire experiment. Use the 1% level of significance to test the claim that the students' responses were uniform (same probability) p(x) = 0.25 for all x.

Tire	0
Left Front	11
Left rear	15
Right Front	12
Right Rear	8
Total	46

 $H_0: p_1 = p_2 = p_3 = p_4 = \frac{1}{4}$  Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

$$E = np_i = 46 \cdot \frac{1}{4} = 11.5$$

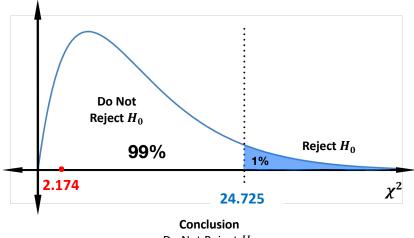


 $p \approx 0.537$ ;  $p \ll \alpha$ ; Accept  $H_0$ The Sample Supports the Claim The distribution is as claimed

Tire	0	E	О-Е	(O-E)^2	(O-E)^2/E
Left Front	11	11.5	-0.5	0.250	0.022
Left rear	15	11.5	3.5	12.250	1.065
Right Front	12	11.5	0.5	0.250	0.022
Right Rear	8	11.5	-3.5	12.250	1.065
Total	46				2.174

 $\chi^2 \approx 2.174$ 

		Area to the Right of the Critical Value									
Degrees of											
Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005	
1	_	_	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879	
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597	
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838	
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860	
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750	
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548	
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278	
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955	
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589	
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188	
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757	
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299	
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819	
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319	
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801	
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267	
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718	
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156	
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582	
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997	
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401	
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796	
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181	
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559	
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928	
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290	
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645	
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993	
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336	
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672	
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766	
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490	
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952	
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215	
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321	
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299	
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169	



 $\begin{array}{c} \textbf{Conclusion}\\ \textbf{Do Not Reject } H_0\\ \textbf{The distribution is as claimed} \end{array}$ 

5. **Student Arrivals-** We know that student arrivals for office hours have a Poisson Distribution with a mean  $\mu$ . We can use the **Goodness of Fit Test** to verify that the distribution is in fact a Poisson Distribution. The following table represent the number of arrivals in a typical office hour for various random days. Use the **5% level of significance** to test the claim that the distribution fits the **expected proportion** below. **Note-**  $\mu = 2.2$  student visitors per office hour.

x	0	p(x)
0	7	0.111
1	18	0.244
2	22	0.268
3	15	0.197
4	10	0.108
5	5	0.048
6	2	0.017
more than 6	1	0.007
Total	80	1

 $H_0: p_1 = 0.111, p_2 = 0.244 \ p_3 = 0.268, \ p_4 = 0.197$  $p_5 = 0.108, \ p_6 = 0.048, \ p_7 = 0.017, \ p_8 = 0.007$  Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

Using the original sample information below we can proceed with  $E = np_i$  for all *i* with n = 80

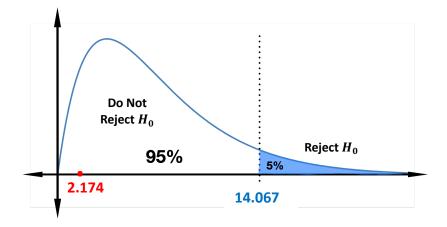


 $p \approx 0.976$ ;  $p \ll \alpha$ ; Accept  $H_0$ The Sample Supports the Claim The distribution is as claimed

x	0	E	О-Е	(O-E)^2	(O-E)^2?E
0	7	8.864	-1.864	3.475	0.392
1	18	19.501	-1.501	2.254	0.116
2	22	21.451	0.549	0.301	0.014
3	15	15.731	-0.731	0.534	0.034
4	10	8.652	1.348	1.817	0.210
5	5	3.807	1.193	1.423	0.374
6	2	1.396	0.604	0.365	0.261
more than 6	1	0.597	0.403	0.162	0.272
Total	80				1.673

## $\chi^2 \approx 1.673$

		Area to the Right of the Critical Value										
Degrees of												
Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005		
1	_	_	0.001	0.004	0.016	2,706	3.841	5.024	6.635	7.879		
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597		
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838		
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860		
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750		
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548		
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278		
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955		
9	1.735	2.088	2.180	3.325	4.168	13.562	16.919	19.023	20.090	23.589		
10	2.156	2.088	3.247	3.940	4.108	15.987	18.307	20.483	23.209	25.188		
								20.403	25.209			
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757		
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299		
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819		
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319		
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801		
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267		
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718		
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156		
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582		
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997		
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401		
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796		
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181		
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559		
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928		
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290		
20	11.808	12.198	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645		
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993		
28	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336		
30	13.787	14.257	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672		
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766		
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490		
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952		
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215		
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321		
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299		
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169		



 $\begin{array}{c} \textbf{Conclusion}\\ \textbf{Do Not Reject } H_0\\ \textbf{The distribution is as claimed} \end{array}$ 

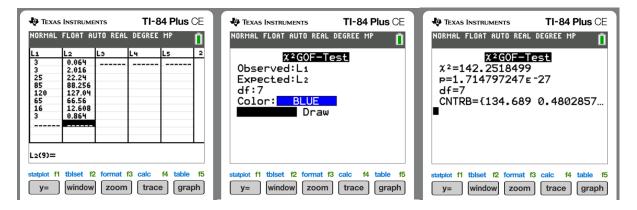
6. Lifespan of US Residents- The Lifespan of US Residents are presumed to be Normally Distributed. The following table represents the counts (frequency) of lifespans for US citizens in the last year. Use the 1% level of significance to test the claim that the distribution fits the expected proportions below. Note-  $\mu = 78.6$ ;  $\sigma = 9.5$ 

x	0	p(x)
Less than 45	3	0.0002
Between 45 and 54.99	3	0.0063
Between 55 and 64.99	25	0.0695
Between 65 and 74.99	85	0.2758
Between 75 and 84.99	120	0.3970
Between 85 and 94.99	65	0.2080
Between 95 and 104.99	16	0.0394
At least 105	3	0.0027
Total	320	0.9989

 $H_0: p_1 = 0.0002, p_2 = 0.0063, p_3 = 0.0695, p_4 = 0.2758$  $p_5 = 0.3970, p_6 = 0.2080, p_7 = 0.0394, p_8 = 0.0027$  Claim

 $H_1$ : At least one  $p_i$  is not equal to what is in the claim.

Using the original sample information below we can proceed with  $E = np_i$  for all *i* with n = 320

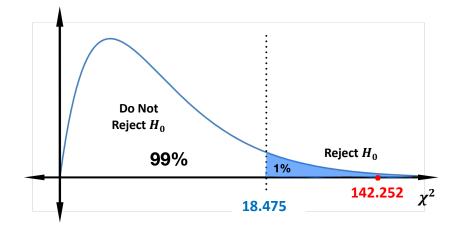


 $p \approx 0.000; p < \alpha; p$  value is low,  $H_0$  has to go! The Sample Does Not Support the Claim The distribution is not as claimed

x	0	E	O-E	(O-E)^2	(O-E)^2/E
Less than 45	3	0.064	2.936	8.620	134.689
Between 45 and 54.99	3	2.016	0.984	0.968	0.480
Between 55 and 64.99	25	22.24	2.76	7.618	0.343
Between 65 and 74.99	85	88.256	-3.256	10.602	0.120
Between 75 and 84.99	120	127.04	-7.04	49.562	0.390
Between 85 and 94.99 65		66.56	-1.56	2.434	0.037
Between 95 and 104.99	16	12.608	3.392	11.506	0.913
At least 105	3	0.864	2.136	4.562	5.281
Total	320				142.252

# $\chi^2 \approx 142.252$

				Are	a to the H	Right of the	e Critical V	alue		
Degrees										
of										
Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	_	_	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.593
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.95
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.26
10	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
20	8.034	8,897	10.283	11.591	13.240	29.615	32.671	35,479	38,932	41.401
	8.034	9.542	10.283	12.338	13.240	30.813	33.924	36.781	40.289	41.401
22 23	9.260	9.342	11.689	12.338	14.042	32.007	35.924	38.076	40.289	44.181
23	9.260	10.196	12.401	13.848	14.848	32.007	36.415	39.364	41.638	44.18
24	9.886	11.524	12.401	13.848	15.659	34.382	36.415	40.646	44.314	45.55
26 27	11.160 11.808	12.198 12.879	13.844 14.573	15.379	17.292 18.114	35.563 36.741	38.885 40.113	41.923 43.194	45.642 46.963	48.290 49.645
27	11.808	12.879	14.573	16.151 16.928	18.114 18.939	36.741 37.916	40.113 41.337	43.194 44.461	46.963 48.278	49.643
28 29	12.461	13.565	15.308	16.928	18.939	37.916	41.337 42.557	44.461 45.722	48.278	52.336
30	13.787	14.257	16.047	17.708	20.599	40.256	42.557	45.722 46.979	49.588	52.550
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169



 $\begin{array}{c} \textbf{Conclusion} \\ \text{Reject } H_0 \\ \text{The distribution is as not as claimed} \end{array}$