

IE 324 - Simulation

Spring 2017

Homework #1

Due: Feb 27, 2017, 5:30 pm

This homework must be done individually. No collaboration is allowed. Violation of academic integrity rules will not be tolerated and may result in serious consequences and disciplinary action.

1. Records pertaining to the monthly number of job-related injuries at an underground coalmine were being studied by a federal agency. The values for the past 100 months were as follows:

<u>Injuries per Month</u>	<u>Frequency of Occurrence</u>
0	32
1	37
2	16
3	8
4	4
5	2
6	1

- a) Apply the chi-square test to these data to test the hypothesis that the underlying distribution is Poisson. Use the level of significance $\alpha = 0.05$.
- b) Apply the chi-square test to these data to test the hypothesis that the underlying distribution is Poisson with mean 1.5. Use the level of significance $\alpha = 0.05$.
- c) What are the differences between parts (a) and (b), and when might each case arise?

Show all your calculations, and write a MATLAB code without any functions for chi-square test.

2. A robot is used to change the tires of cars in a formula race. It was thought that the changing times followed a normal distribution. A sample of 50 changing times was automatically taken by the robot, with the following results, where the values are in seconds:

65.1889877218969	587.800293853101	134.252125089067	110.736730040335	262.096456598498
31.4786278289440	9.49594843983253	1060.13262520787	1096.71214094231	306.525714949319
656.537747516376	13.9273877172570	52.0299240180813	408.497604442341	85.0084939264998
28.8260250311400	229.962257260499	21.7245728368395	978.408311996415	72.9056726202052
145.803081127352	70.8795228608427	123.287200047947	741.803981935382	533.626204129967
740.468412522953	621.242219817558	88.2569004608498	61.7965970432501	227.098603377514
406.693032618397	274.655800756737	94.4498825809915	115.831860792137	257.173596487731
192.005241316558	28.0051822986548	297.752388433563	365.397148817626	138.859284923487
13.8144355948146	74.1051892183200	134.379636471092	16.2441292116040	109.244808045944
11.3712032596828	13.1553864443499	561.518195772799	1071.61197742093	89.5414985987764

- a) Compute the sample mean and sample variance.
- b) Using the Q – Q plot of the changing times, decide whether the data is from a normal distribution.
- c) If the data is not from a normal distribution, propose a distribution and check it with its Q – Q plot.

3. Apply the chi-square test for the data below to test the hypothesis that the underlying distribution is normal, $\alpha = 0.05$. Use class interval endpoints $[-\infty, 6, 8.5, 11, 14.5, 16, 18.5, 21, \infty]$. Show all your calculations, and write a MATLAB code without any functions for chi-square test.

15.030802275	17.416526445	8.3044664550	5.7191089470
21.252648075	15.939048645	12.821323638	5.6225955600
1.6075350675	10.993483561	6.6222381900	14.793330768
16.588431945	13.860583042	7.1051964405	11.598599248
13.980073152	8.6710425420	12.417123225	11.508943258
6.1730961780	16.714299030	19.806625485	19.262688720
10.368758293	6.9440634870	8.7556036140	13.849604995
14.094597439	7.3194218010	14.232618301	13.399493056
29.626305315	8.5644062670	11.367194869	20.070955635
25.743297750	-1.6825639770	17.813309460	8.5885634100
5.9705426865	19.354225410	7.2224913840	15.793797195
27.017632635	14.010914589	12.606275827	16.458423195
15.931940280	8.8263440685	15.102129705	11.280167326
12.147336609	19.027432995	17.732929050	13.485216414
15.880765935	4.2347211900	19.862217105	6.8539491285
11.466162919	11.959236259	12.862469439	6.9398266620
11.854107129	11.291054200	5.2903665090	12.953398636
19.600548510	13.982192347	8.8869511815	15.916819350
19.213365555	13.951721263	7.3544076795	24.860358015
19.252523580	8.2985763975	23.732194680	9.2489247810
15.673186245	12.305753778	9.4951109685	13.349188918
6.6540627705	11.658580708	16.040768565	12.054026758
15.892745520	15.462994980	11.526391149	3.1714899945
20.275129395	17.697675210	16.715330040	10.342962460
14.796690097	17.774511825	8.7787236645	3.8355415605

4. The time required for 50 different employees to compute and record the average number of hours worked per day during the week was measured, with the following results in hours:

Employee	Time (Hours)	Employee	Time (Hours)
1	5.392044361	31	1.787801493
2	1.310604917	32	3.950298313
3	0.947304887	33	0.849122425
4	1.317009041	34	2.560570491
5	2.415487935	35	4.261427302
6	1.829651644	36	0.255983933
7	3.688820093	37	0.538722246
8	0.894017121	38	2.430383866
9	5.053375758	39	1.928076259
10	1.139564965	40	2.166427692
11	5.142034319	41	6.391477971
12	3.027805885	42	4.879973051
13	1.422423179	43	3.062868694
14	0.752646789	44	5.968888072
15	7.617623213	45	0.688325783
16	0.222094268	46	6.653847224
17	0.770246375	47	6.050274995
18	2.183364296	48	7.190051545
19	2.518541664	49	6.019025498
20	2.443460128	50	3.379073492
21	3.587877557	51	4.749034106
22	2.050993592	52	0.324219357
23	2.037527064	53	3.430659134
24	0.610646389	54	6.867082925
25	0.696406167	55	0.406527867
26	0.614718774	56	6.982467165
27	0.296836948	57	3.835030857
28	6.191016019	58	1.810533280
29	0.271823434	59	0.136573541
30	1.3748928562	60	0.1007564054

Apply the chi-square test to test the hypothesis that these service times are exponentially distributed. Let the number of class intervals be $k=7$. Use the level of significance $\alpha = 0.05$. Show all your calculations, and write a MATLAB code without any functions for chi-square test.