MTH5129 Probability & Statistics II
Coursework 8

1. A computer scientist has developed an algorithm for generating pseudo-random integers $0, 1, \ldots, 9$. He codes the algorithm and generates 1000 pseudo-random digits. The data are as follows

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	94	93	112	101	104	95	100	99	108	94

   Test whether there is evidence against the hypothesis that the digits are all equally likely.

2. The lifetime (in hours) of 500 batteries was recorded and is shown in the following frequency table.

Time	0-50	50-100	100-150	150-200	200-250
Frequency	218	117	70	35	25
Time	250-300	300-350	350-400	400+	
Frequency	18	11	6	0	

   Test the hypothesis that the distribution of lifetimes follows an exponential distribution at the 5% significance level.

3. 100 observations on a continuous random variable Y gave the following frequency table

Interval	$0 - \pi/4$	$\pi/4 - \pi/2$	$\pi/2 - 3\pi/4$	$3\pi/4 - \pi$
Frequency	10	38	41	11

   Test the hypothesis that Y has the pdf

   $$f(y) = \begin{cases} \frac{1}{2}\sin y & 0 \leq y \leq \pi \\ 0 & \text{otherwise,} \end{cases}$$

   using the 5% significance level.

4. Five dice were thrown 150 times and the number of sixes was recorded. The data are given in the following table.

No. of sixes	0	1	2	3	4	5
Frequency	46	63	23	12	5	1

   We want to know if there is any evidence that the dice are not fair. Compute the p-value.

5. The masses measured on a population of 100 animals were grouped in the following table, after being recorded to the nearest gram

Mass	≤ 89	90-109	110-129	130-149	150-169	170-189	≥ 190
Frequency	3	7	34	43	10	2	1

You are given that the sample mean of the data is 131.5 and the sample standard deviation is 20.0. Test the hypothesis that the distribution of masses follows a normal distribution at the 5% significance level.

You are given the following values from R:

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> pchisq(3.72, 9)
[1] 0.07114341
> qchisq(0.95,5)
[1] 11.0705
> qchisq(0.95,6)
[1] 12.59159
> qchisq(0.95,7)
[1] 14.06714
> qchisq(0.95,8)
[1] 15.50731
> qchisq(0.95,9)
[1] 16.91898
> qchisq(0.95,4)
[1] 9.487729
> qchisq(0.95,3)
[1] 7.814728
> qchisq(0.95,2)
[1] 5.991465
> pchisq(33.99,3)
[1] 0.9999998
> pnorm(-2.1)
[1] 0.01786442
> pnorm(-1.1)
[1] 0.1356661
> pnorm(-0.1)
[1] 0.4601722
> pnorm(0.9)
[1] 0.8159399
> pnorm(1.9)
[1] 0.9712834
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> pnorm(2.9)
[1] 0.9981342
> qchisq(0.95,1)
[1] 3.841459
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