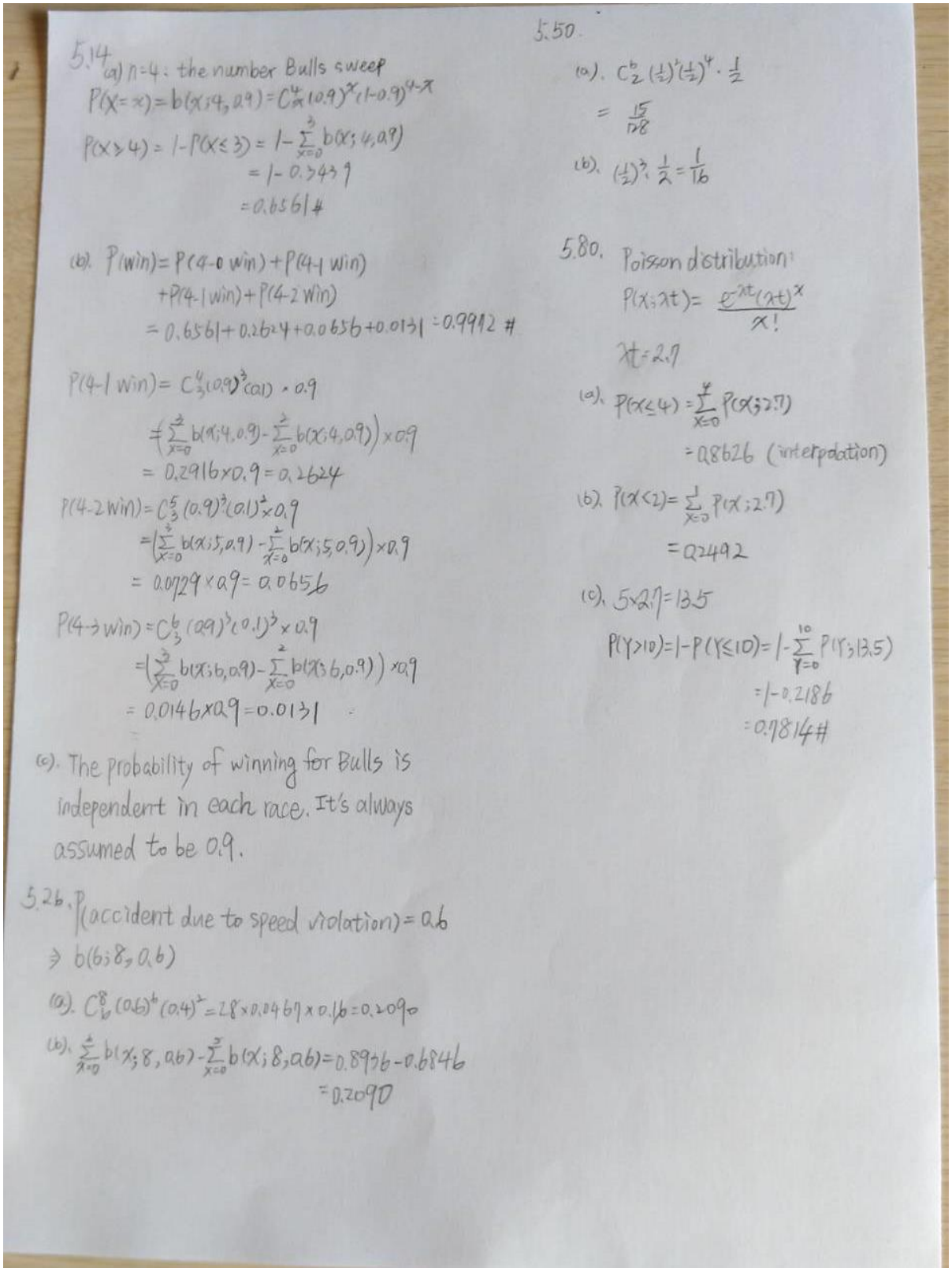
Writing



5.14 (a) $n=4$: the number Bulls sweep

$P(X=x)=b(x;4,0.9)=C_x^4(0.9)^x(1-0.9)^{4-x}$

$P(X\geq 4)=1-P(X\leq 3)=1-\sum_{x=0}^{3}b(x;4,0.9)$

$=1-0.3439$

$=0.6561$ #

(b). $P(\text{win})=P(4\text{-}0\ \text{win})+P(4\text{-}1\ \text{win})+P(4\text{-}2\ \text{win})+P(4\text{-}3\ \text{win})$

$=0.6561+0.2624+0.0656+0.0131=0.9992$ #

$P(4\text{-}1\ \text{win})=C_3^4(0.9)^3(0.1)\cdot 0.9$

$=\left(\sum_{x=0}^{3}b(x;4,0.9)-\sum_{x=0}^{2}b(x;4,0.9)\right)\times 0.9$

$=0.2916\times 0.9=0.2624$

$P(4\text{-}2\ \text{win})=C_3^5(0.9)^3(0.1)^2\times 0.9$

$=\left(\sum_{x=0}^{3}b(x;5,0.9)-\sum_{x=0}^{2}b(x;5,0.9)\right)\times 0.9$

$=0.0729\times 0.9=0.0656$

$P(4\text{-}3\ \text{win})=C_3^6(0.9)^3(0.1)^3\times 0.9$

$=\left(\sum_{x=0}^{3}b(x;6,0.9)-\sum_{x=0}^{2}b(x;6,0.9)\right)\times 0.9$

$=0.0146\times 0.9=0.0131$

(c). The probability of winning for Bulls is independent in each race. It's always assumed to be 0.9.

5.26. $P(\text{accident due to speed violation})=0.6$

$\Rightarrow b(6;8,0.6)$

(a). $C_6^8(0.6)^6(0.4)^2=28\times 0.0467\times 0.16=0.2090$

(b). $\sum_{x=0}^{4}b(x;8,0.6)-\sum_{x=0}^{3}b(x;8,0.6)=0.8936-0.6846$

$=0.2090$

5.50.

(a). $C_2^5(\frac{1}{2})^2(\frac{1}{2})^4\cdot\frac{1}{2}$

$=\frac{15}{128}$

(b). $(\frac{1}{2})^3\cdot\frac{1}{2}=\frac{1}{16}$

5.80. Poisson distribution:

$P(x;\lambda t)=\frac{e^{-\lambda t}(\lambda t)^x}{x!}$

$\lambda t=2.7$

(a). $P(x\leq 4)=\sum_{x=0}^{4}P(x;2.7)$

$=0.8626$ (interpolation)

(b). $P(x<2)=\sum_{x=0}^{1}P(x;2.7)$

$=0.2492$

(c). $5\times 2.7=13.5$

$P(Y>10)=1-P(Y\leq 10)=1-\sum_{Y=0}^{10}P(Y;13.5)$

$=1-0.2186$

$=0.7814$#

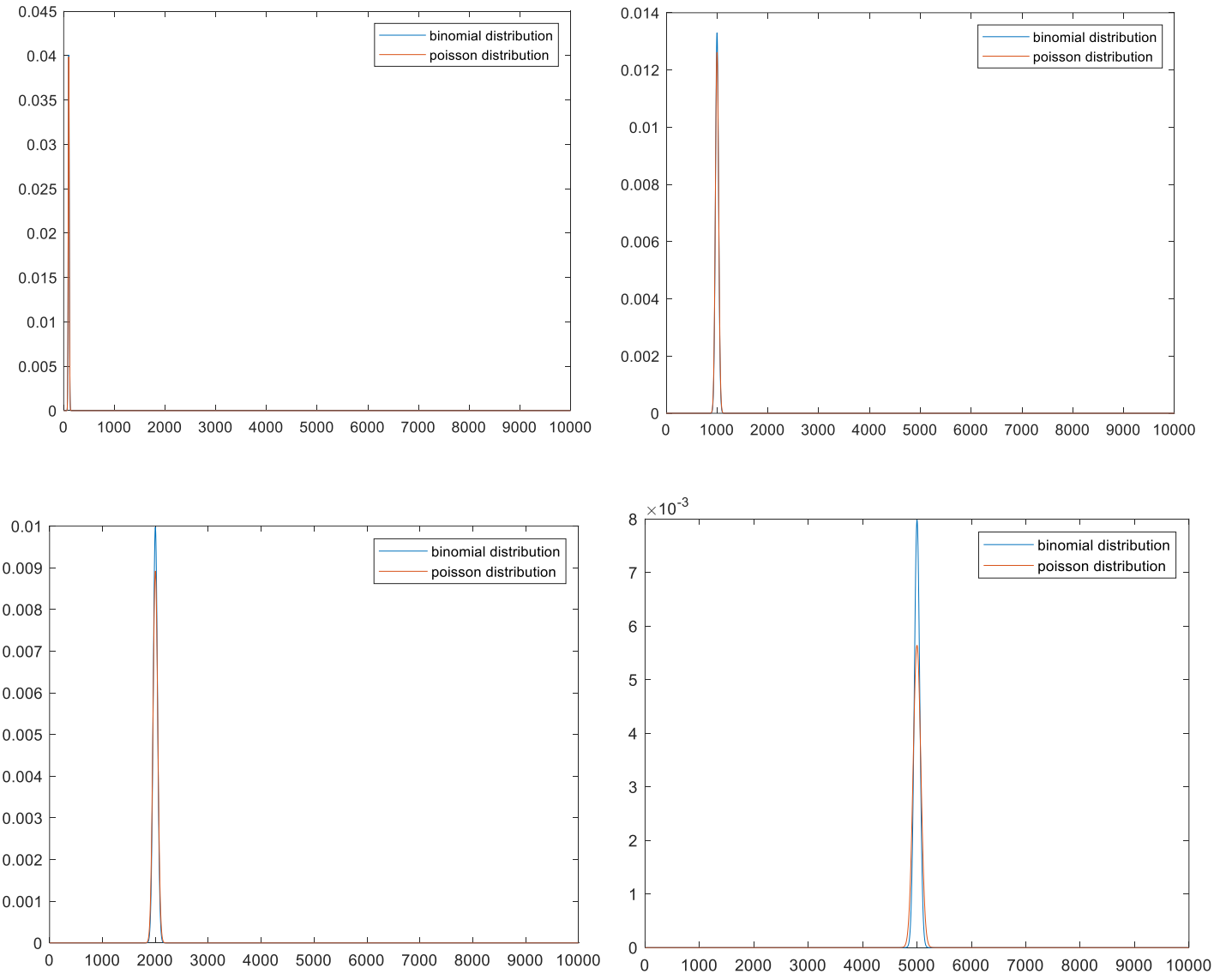
Matlab

n	r	p0_1	p0_2	p0_25	p0_3	p0_4	p0_5	p0_6	p0_7	p0_8	p0_9
1	0	0.9	0.8	0.75	0.7	0.6	0.5	0.4	0.3	0.2	0.1
	1	1	1	1	1	1	1	1	1	1	1
2	0	0.81	0.64	0.5625	0.49	0.36	0.25	0.16	0.09	0.04	0.01
	1	0.99	0.96	0.9375	0.91	0.84	0.75	0.64	0.51	0.36	0.19
	2	1	1	1	1	1	1	1	1	1	1
3	0	0.729	0.512	0.4219	0.343	0.216	0.125	0.064	0.027	0.008	0.001
	1	0.972	0.896	0.8438	0.784	0.648	0.5	0.352	0.216	0.104	0.028
	2	0.999	0.992	0.9844	0.973	0.936	0.875	0.784	0.657	0.488	0.271
	3	1	1	1	1	1	1	1	1	1	1
4	0	0.6561	0.4096	0.3164	0.2401	0.1296	0.0625	0.0256	0.0081	0.0016	0.0001
	1	0.9477	0.8192	0.7383	0.6517	0.4752	0.3125	0.1792	0.0837	0.0272	0.0037
	2	0.9963	0.9728	0.9492	0.9163	0.8208	0.6875	0.5248	0.3483	0.1808	0.0523
	3	0.9999	0.9984	0.9961	0.9919	0.9744	0.9375	0.8704	0.7599	0.5904	0.3439
	4	1	1	1	1	1	1	1	1	1	1
5	0	0.5905	0.3277	0.2373	0.1681	0.0778	0.0313	0.0102	0.0024	0.0003	0
	1	0.9185	0.7373	0.6328	0.5282	0.337	0.1875	0.087	0.0308	0.0067	0.0005
	2	0.9914	0.9421	0.8965	0.8369	0.6826	0.5	0.3174	0.1631	0.0579	0.0086
	3	0.9995	0.9933	0.9844	0.9692	0.913	0.8125	0.663	0.4718	0.2627	0.0815
	4	1	0.9997	0.999	0.9976	0.9898	0.9688	0.9222	0.8319	0.6723	0.4095
	5	1	1	1	1	1	1	1	1	1	1
6	0	0.5314	0.2621	0.178	0.1176	0.0467	0.0156	0.0041	0.0007	0.0001	0
	1	0.8857	0.6554	0.5339	0.4202	0.2333	0.1094	0.041	0.0109	0.0016	0.0001
	2	0.9842	0.9011	0.8306	0.7443	0.5443	0.3438	0.1792	0.0705	0.017	0.0013
	3	0.9987	0.983	0.9624	0.9295	0.8208	0.6563	0.4557	0.2557	0.0989	0.0158
	4	0.9999	0.9984	0.9954	0.9891	0.959	0.8906	0.7667	0.5798	0.3446	0.1143
	5	1	0.9999	0.9998	0.9993	0.9959	0.9844	0.9533	0.8824	0.7379	0.4686
	6	1	1	1	1	1	1	1	1	1	1
7	0	0.4783	0.2097	0.1335	0.0824	0.028	0.0078	0.0016	0.0002	0	0
	1	0.8503	0.5767	0.4449	0.3294	0.1586	0.0625	0.0188	0.0038	0.0004	0
	2	0.9743	0.852	0.7564	0.6471	0.4199	0.2266	0.0963	0.0288	0.0047	0.0002
	3	0.9973	0.9667	0.9294	0.874	0.7102	0.5	0.2898	0.126	0.0333	0.0027
	4	0.9998	0.9953	0.9871	0.9712	0.9037	0.7734	0.5801	0.3529	0.148	0.0257
	5	1	0.9996	0.9987	0.9962	0.9812	0.9375	0.8414	0.6706	0.4233	0.1497
	6	1	1	0.9999	0.9998	0.9984	0.9922	0.972	0.9176	0.7903	0.5217
	7	1	1	1	1	1	1	1	1	1	1

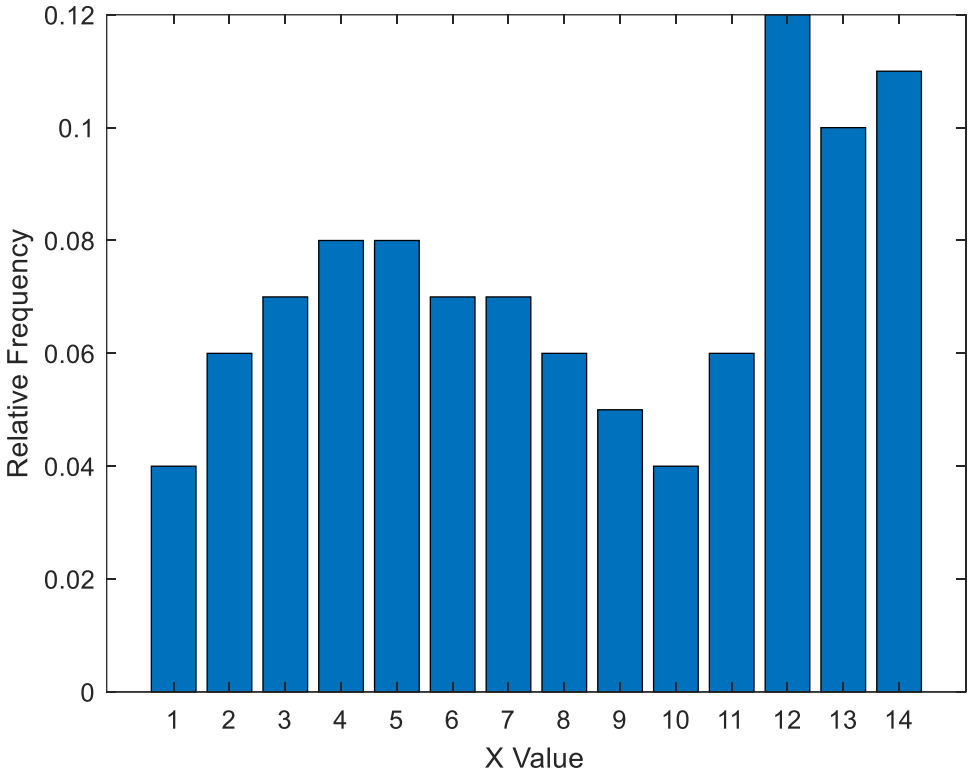
↑ 1-c

r	mean5_5	mean6_0	mean6_5	mean7_0	mean7_5	mean8_0	mean8_5	mean9_0	mean9_5
0	0.0041	0.0025	0.0015	0.0009	0.0006	0.0003	0.0002	0.0001	0.0001
1	0.0266	0.0174	0.0113	0.0073	0.0047	0.003	0.0019	0.0012	0.0008
2	0.0884	0.062	0.043	0.0296	0.0203	0.0138	0.0093	0.0062	0.0042
3	0.2017	0.1512	0.1118	0.0818	0.0591	0.0424	0.0301	0.0212	0.0149
4	0.3575	0.2851	0.2237	0.173	0.1321	0.0996	0.0744	0.055	0.0403
5	0.5289	0.4457	0.369	0.3007	0.2414	0.1912	0.1496	0.1157	0.0885
6	0.686	0.6063	0.5265	0.4497	0.3782	0.3134	0.2562	0.2068	0.1649
7	0.8095	0.744	0.6728	0.5987	0.5246	0.453	0.3856	0.3239	0.2687
8	0.8944	0.8472	0.7916	0.7291	0.662	0.5925	0.5231	0.4557	0.3918
9	0.9462	0.9161	0.8774	0.8305	0.7764	0.7166	0.653	0.5874	0.5218
10	0.9747	0.9574	0.9332	0.9015	0.8622	0.8159	0.7634	0.706	0.6453
11	0.989	0.9799	0.9661	0.9467	0.9208	0.8881	0.8487	0.803	0.752
12	0.9955	0.9912	0.984	0.973	0.9573	0.9362	0.9091	0.8758	0.8364
13	0.9983	0.9964	0.9929	0.9872	0.9784	0.9658	0.9486	0.9261	0.8981
14	0.9994	0.9986	0.997	0.9943	0.9897	0.9827	0.9726	0.9585	0.94
15	0.9998	0.9995	0.9988	0.9976	0.9954	0.9918	0.9862	0.978	0.9665
16	0.9999	0.9998	0.9996	0.999	0.998	0.9963	0.9934	0.9889	0.9823
17	1	0.9999	0.9998	0.9996	0.9992	0.9984	0.997	0.9947	0.9911
18	1	1	0.9999	0.9999	0.9997	0.9993	0.9987	0.9976	0.9957
19	1	1	1	1	0.9999	0.9997	0.9995	0.9989	0.998
20	1	1	1	1	1	0.9999	0.9998	0.9996	0.9991
21	1	1	1	1	1	1	0.9999	0.9998	0.9996
22	1	1	1	1	1	1	1	0.9999	0.9999
23	1	1	1	1	1	1	1	1	0.9999
24	1	1	1	1	1	1	1	1	1

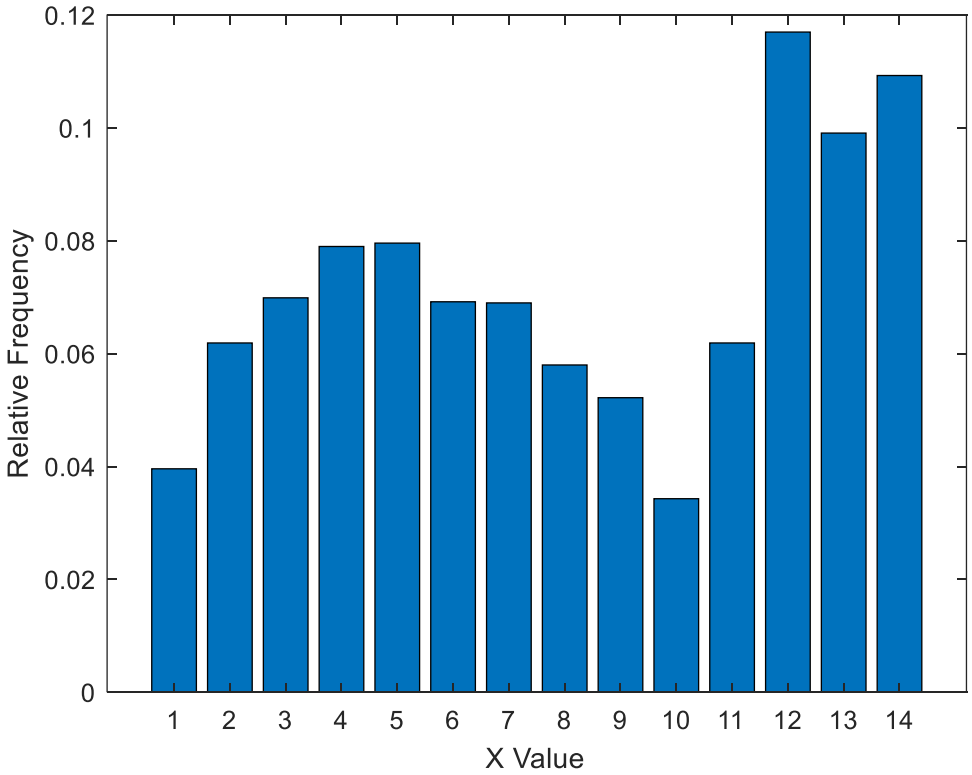
↑ 1-d



↑從左上順時針依序為：p=0.01, p=0.1, p=0.2, p=0.5。p=0.01 時兩個分布幾乎疊合在一起，正確率甚高；p=0.1 時二項分布更集中一點(高峰處更高)；p=0.2 右更集中；到 p=0.5 時已可用肉眼看出兩者的差異了。這是因為對一個二項分布來說，當 n 夠大且 p 夠小時，可以將整個試驗看作是連續的時/空。每次試驗(每段時/空)的機率互相獨立；且每次試驗(每段時/空)發生事件的機率都甚小，如此二項分布就可趨近帕松分布。而 p=0.2 甚至是 0.5 時，已經不算小了，所以趨近也變得不精確許多了。



↑2-a



↑2-b。兩圖基本上是一樣的，這是因為我使用的 matlab 的 randi 函數是偽隨機，而我的母體又是照順序排列的，所以在取樣時每個事件的次數就會大致依

照各自的發生機率。