

Handwrite

5.14

$$(a) \quad n=4 \quad P(X=4) = b(4, 4, 87.7\%) \\ \approx \binom{4}{4} \cdot 0.9^4 \cdot 0.1^0 = 0.6561$$

$$(b) \quad X=4, \quad n=4, 5, 6, 7$$

$$P = b(4, 4, 0.877) + b(4, 5, 0.877) \\ + b(4, 6, 0.877) + b(4, 7, 0.877)$$

$$= 0.6561 + \binom{6}{3} 0.9^4 \cdot 0.1 + \binom{5}{3} 0.9^4 \cdot 0.1^2 \\ + \binom{6}{3} 0.9^4 \cdot 0.1^3$$

$$= 0.9973$$

(c) the percentage of wins is 0.9 and it is fixed.

5.26

$$p=0.6 \quad n=8 \quad x=6$$

$$(a) \quad b(6, 8, 0.6) = \binom{8}{6} 0.6^6 0.4^2$$

$$= 28 \cdot 0.0467 \times 0.16$$

$$= 0.2090$$

$$(b) \quad b(6, 8, 0.6) = \sum_{x=0}^6 b(x, 8, 0.6) - \sum_{x=0}^5 b(x, 8, 0.6)$$

$$= 0.8936 - 0.6846 = 0.2090$$

5.50

$$(a) \quad b^*(7, 3, 0.5) = \binom{6}{2} 0.5^3 \cdot 0.5^4 = \frac{15}{128} = 0.1172$$

$$(b) \quad b^*(4, 1, 0.5) = \binom{3}{0} 0.5^1 0.5^3 = \frac{1}{16}$$

5.80

$$\begin{aligned} \text{(a)} \quad t &= 1 \text{ min} \quad \lambda t = 2.7 \\ P(X \leq 4) &= \sum_{x=0}^4 P(x, 2.7) = \sum_{x=0}^4 \frac{e^{-2.7} (2.7)^x}{x!} \\ &= 0.8629 \end{aligned}$$

(b) $t = 1 \text{ min}$ $\lambda t = 2,7$

$$P(X < 2) = \sum_{x=0}^1 p(x, 2,7) = \sum_{x=0}^1 \frac{e^{-2,7} (2,7)^x}{x!}$$
$$= 0,2487$$

c) $t=5$ $\lambda t=13.5$

$$P(X > 10) = 1 - P(X \leq 10) = 1 - \sum_{x=0}^{10} p(x, 13.5)$$
$$= 1 - 0.2112 = 0.7888$$

Matlab

1(a)

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function [probability]=HW5_1_a(k,n,p)
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(k, n, p): k-成功次數，n-實驗次數，p-成功率

Probability: probability of distribution when $X=k$

1(b)

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function [probability]=HW5_1_b(x,t)
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(x, t) : x -成功次數， $t-\lambda t$

Probability: probability of distribution when $X=x$

1(c)

[illegible]

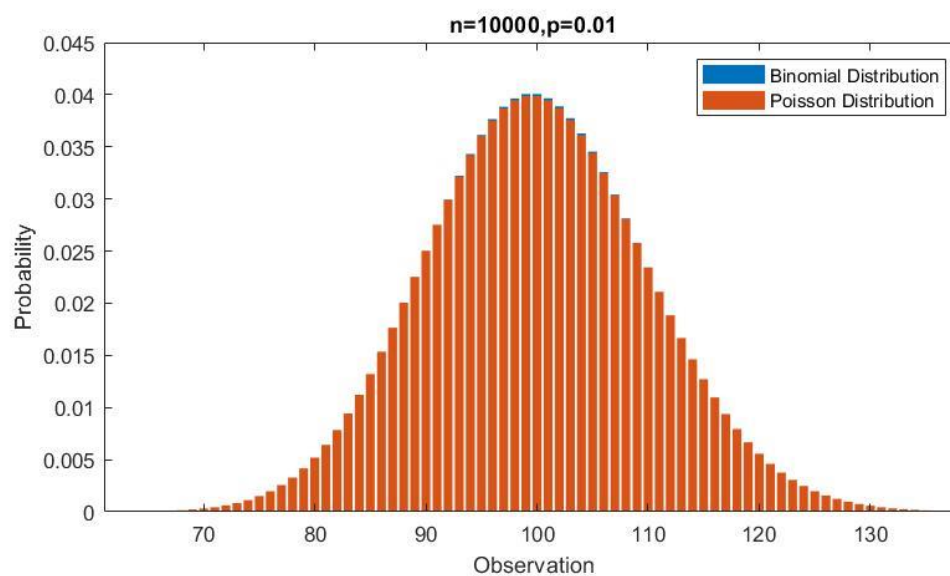
4	0	0.6561	0.4096	0.3164	0.2401	0.1296	0.0625	0.0256	0.0081	0.0016	0.0001
	1	0.9477	0.8192	0.7383	0.6517	0.4752	0.3125	0.1792	0.0837	0.0272	0.0037
	2	0.9963	0.9728	0.9492	0.9163	0.8208	0.6875	0.5248	0.3483	0.1808	0.0523
	3	0.9999	0.9984	0.9961	0.9919	0.9744	0.9375	0.8704	0.7599	0.5904	0.3439
	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	0	0.5905	0.3277	0.2373	0.1681	0.0778	0.0313	0.0102	0.0024	0.0003	0.0000
	1	0.9185	0.7373	0.6328	0.5282	0.3370	0.1875	0.0870	0.0308	0.0067	0.0005
	2	0.9914	0.9421	0.8965	0.8369	0.6826	0.5000	0.3174	0.1631	0.0579	0.0086
	3	0.9995	0.9933	0.9844	0.9692	0.9130	0.8125	0.6630	0.4718	0.2627	0.0815
	4	1.0000	0.9997	0.9990	0.9976	0.9898	0.9688	0.9222	0.8319	0.6723	0.4095
	5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	0	0.5314	0.2621	0.1780	0.1176	0.0467	0.0156	0.0041	0.0007	0.0001	0.0000
	1	0.8857	0.6554	0.5339	0.4202	0.2333	0.1094	0.0410	0.0109	0.0016	0.0001
	2	0.9842	0.9011	0.8306	0.7443	0.5443	0.3438	0.1792	0.0705	0.0170	0.0013
	3	0.9987	0.9830	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	0.9590	0.8906	0.7667	0.5798	0.3446	0.1143
	5	1.0000	0.9999	0.9998	0.9993	0.9959	0.9844	0.9533	0.8824	0.7379	0.4686
	6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	0	0.4783	0.2097	0.1335	0.0824	0.0280	0.0078	0.0016	0.0002	0.0000	0.0000
	1	0.8503	0.5767	0.4449	0.3294	0.1586	0.0625	0.0188	0.0038	0.0004	0.0000
	2	0.9743	0.8520	0.7564	0.6471	0.4199	0.2266	0.0963	0.0288	0.0047	0.0002
	3	0.9973	0.9667	0.9294	0.8740	0.7102	0.5000	0.2898	0.1260	0.0333	0.0027
	4	0.9998	0.9953	0.9871	0.9712	0.9037	0.7734	0.5801	0.3529	0.1480	0.0257
	5	1.0000	0.9996	0.9987	0.9962	0.9812	0.9375	0.8414	0.6706	0.4233	0.1497
	6	1.0000	1.0000	0.9999	0.9998	0.9984	0.9922	0.9720	0.9176	0.7903	0.5217
	7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

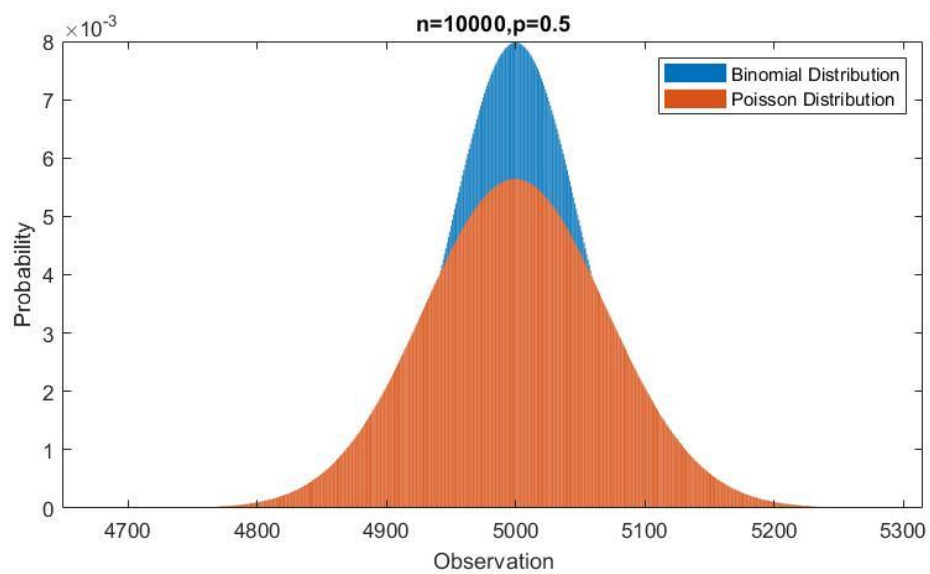
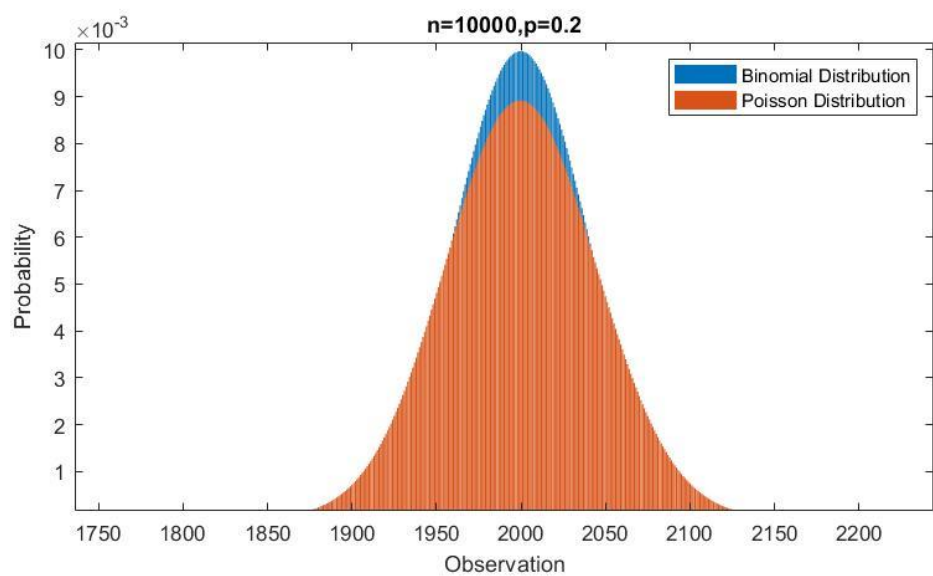
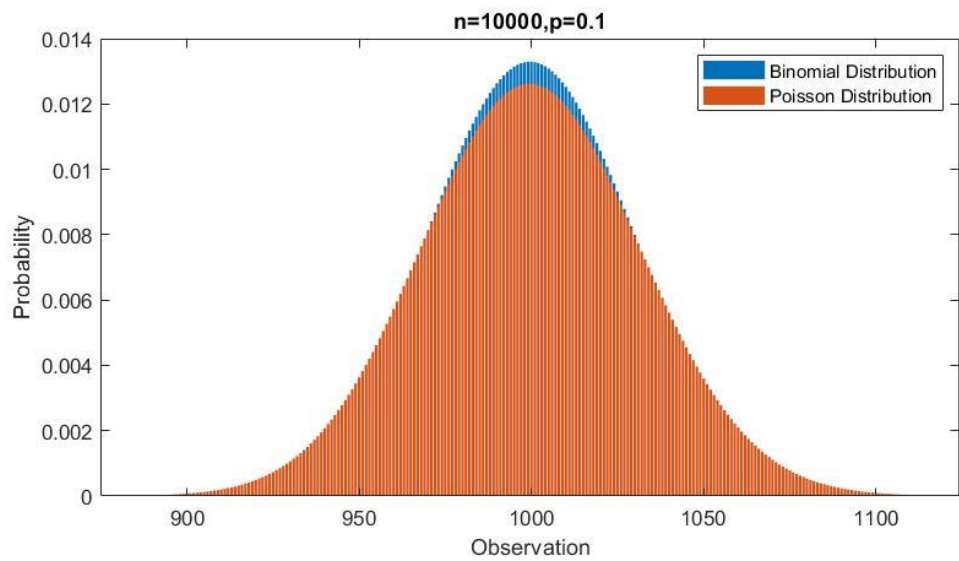
1(d)

r	μ								
	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
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	0.0030	0.0019	0.0012	0.0008
2	0.0884	0.0620	0.0430	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	0.1730	0.1321	0.0996	0.0744	0.0550	0.0403
5	0.5289	0.4457	0.3690	0.3007	0.2414	0.1912	0.1496	0.1157	0.0885
6	0.6860	0.6063	0.5265	0.4497	0.3782	0.3134	0.2562	0.2068	0.1649
7	0.8095	0.7440	0.6728	0.5987	0.5246	0.4530	0.3856	0.3239	0.2687
8	0.8944	0.8472	0.7916	0.7291	0.6620	0.5925	0.5231	0.4557	0.3918
9	0.9462	0.9161	0.8774	0.8305	0.7764	0.7166	0.6530	0.5874	0.5218
10	0.9747	0.9574	0.9332	0.9015	0.8622	0.8159	0.7634	0.7060	0.6453

11	0.9890	0.9799	0.9661	0.9467	0.9208	0.8881	0.8487	0.8030	0.7520
12	0.9955	0.9912	0.9840	0.9730	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	0.9970	0.9943	0.9897	0.9827	0.9726	0.9585	0.9400
15	0.9998	0.9995	0.9988	0.9976	0.9954	0.9918	0.9862	0.9780	0.9665
16	0.9999	0.9998	0.9996	0.9990	0.9980	0.9963	0.9934	0.9889	0.9823
17	1.0000	0.9999	0.9998	0.9996	0.9992	0.9984	0.9970	0.9947	0.9911
18	1.0000	1.0000	0.9999	0.9999	0.9997	0.9993	0.9987	0.9976	0.9957
19	1.0000	1.0000	1.0000	1.0000	0.9999	0.9997	0.9995	0.9989	0.9980
20	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9998	0.9996	0.9991
21	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9998	0.9996
22	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9999
23	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999
24	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

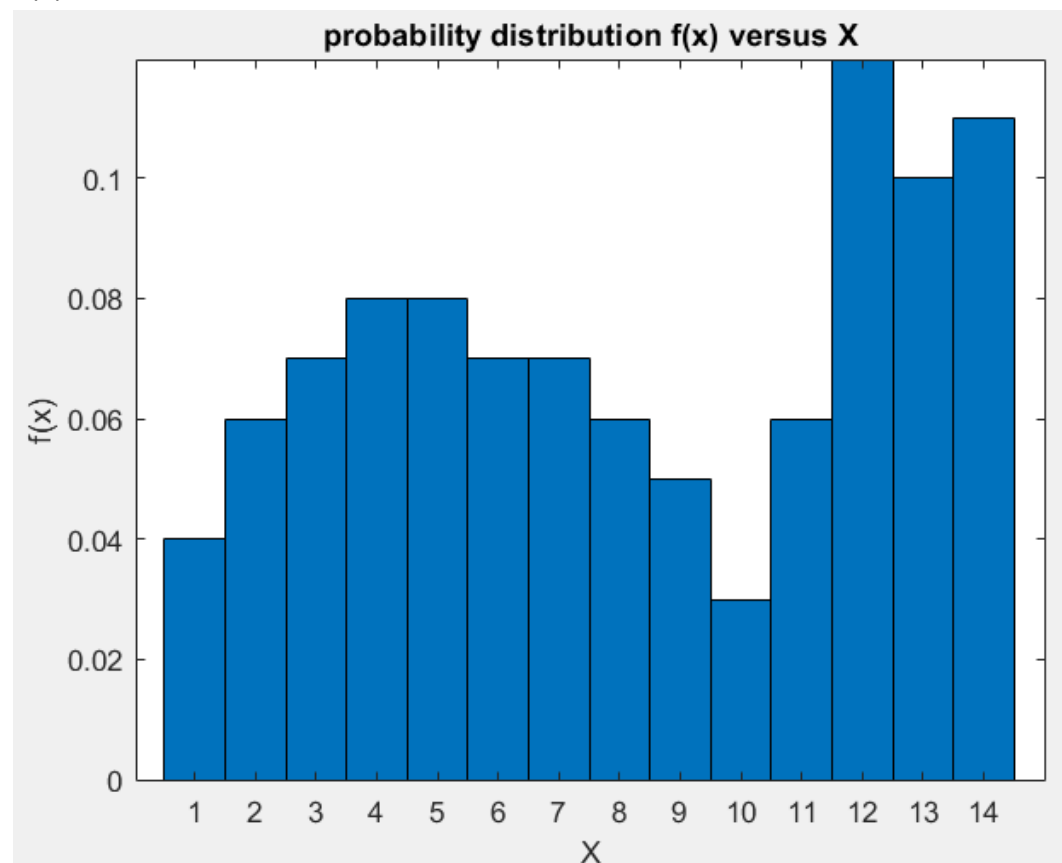
1(e)





上面四張圖，藍色都是 binomial distribution，紅色則為 poisson distribution；標題則寫了他們的 n 和 p ，將 n 和 p 相乘即為 poisson distribution 的參數 λ 。從四張圖的比對可以發現，當 $p=0.01$ 時，binomial distribution 幾乎等於 poisson distribution，而他們的誤差隨著 p 越接近 0.5 而越明顯；表示在事件次數固定的情況下， p 要越小(或是 $1-p$ 要越小)其兩者才會接近，而當 p 或 $1-p$ 越遠離 0，誤差就越明顯。

2(a)



2(b)

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function [X]=HW5_2_bfun
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利用這個程式產生隨機的 X 並畫出relative frequency，結果如下，可以發現雖然有些許差距，但產生出來的分佈大致和 X 的probability distribution是相同的，而因為 X 是由亂數隨機產生再分類的，所以結果是合理的。

