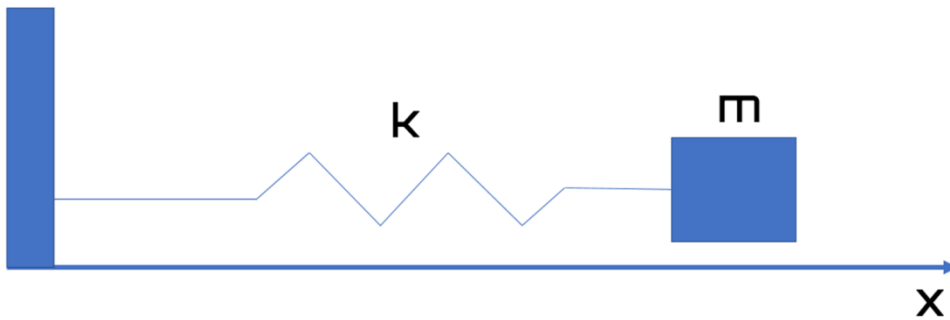
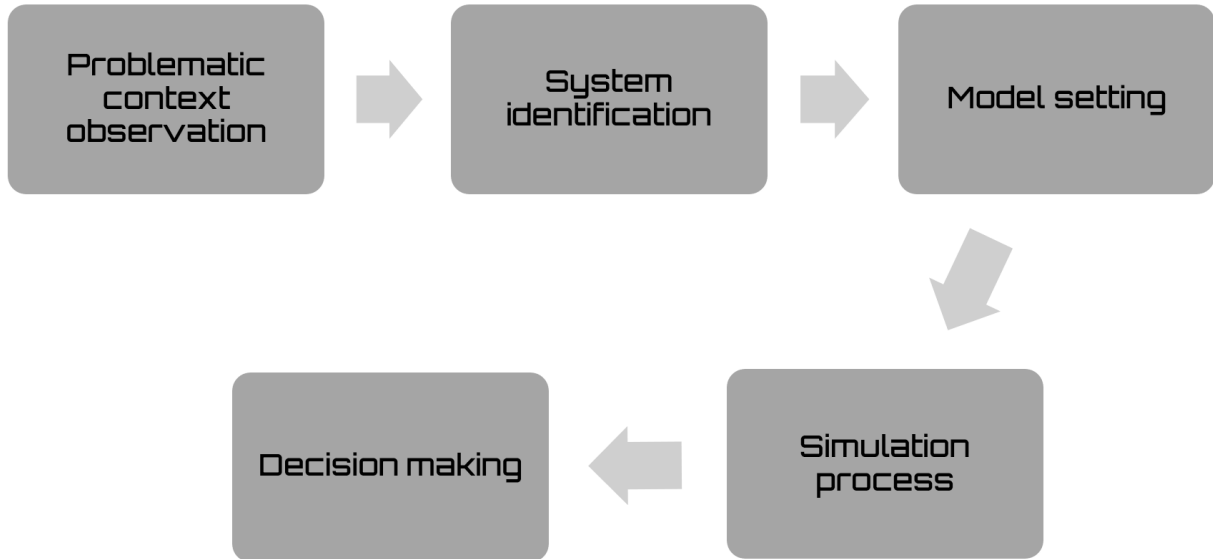
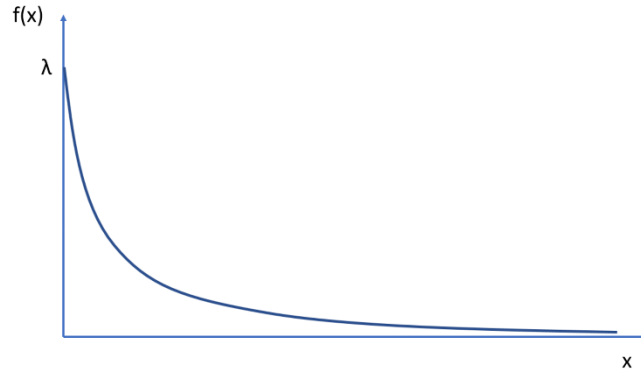
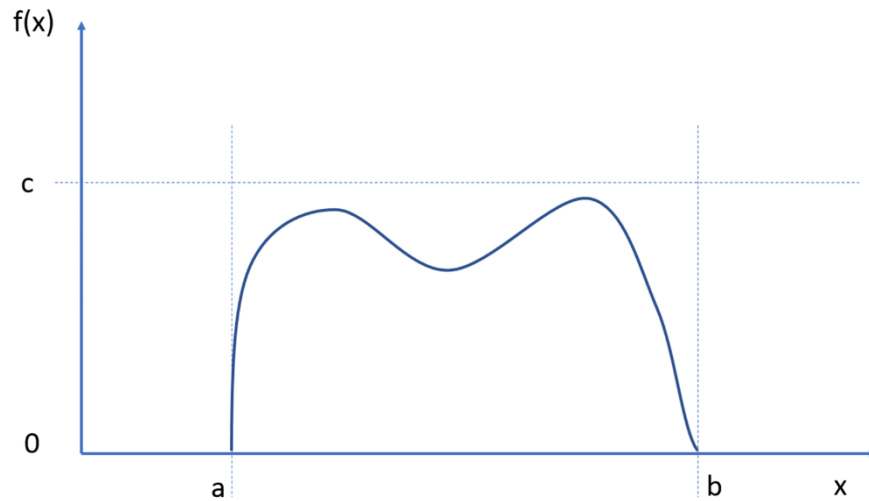


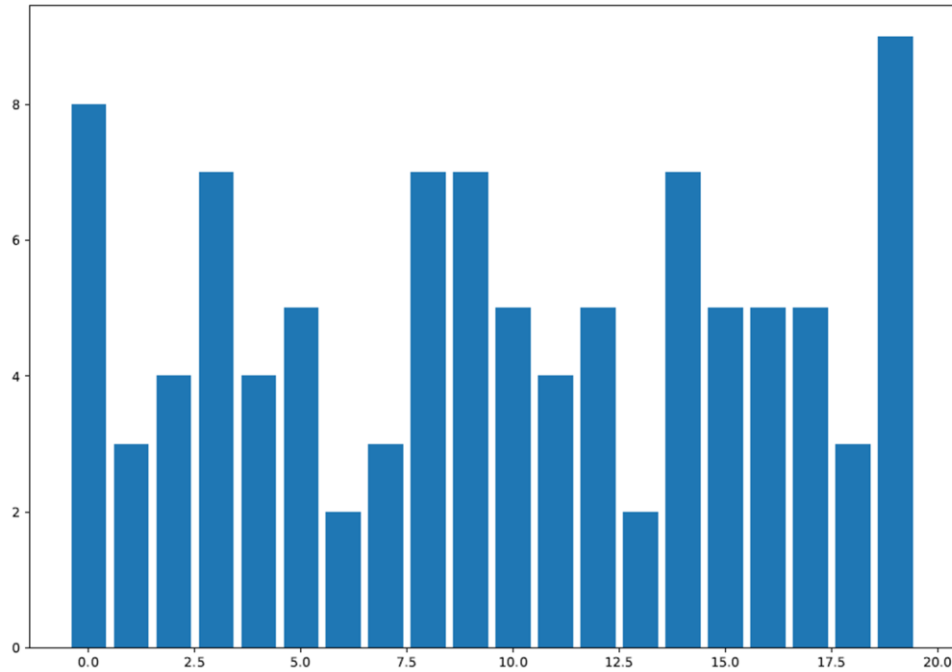
## Chapter 1: Introducing simulation models



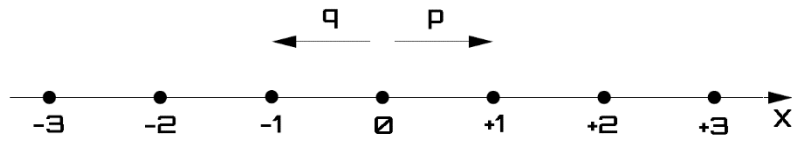
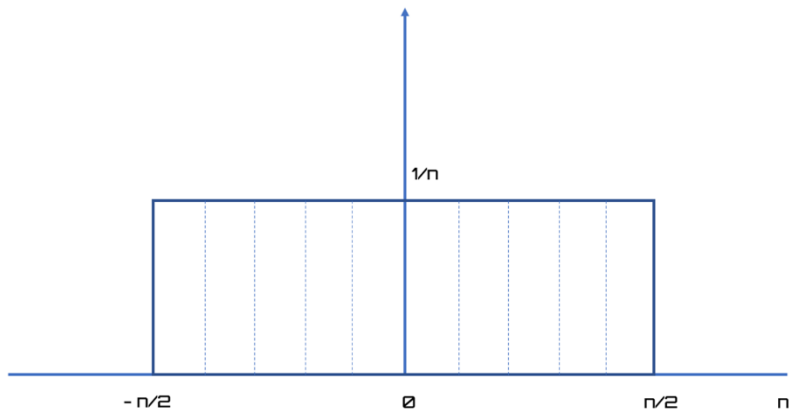
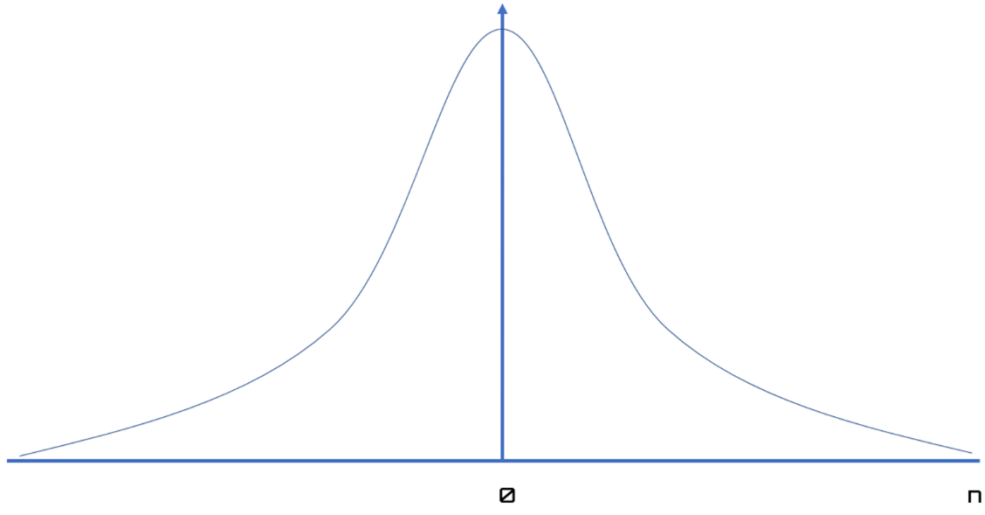
## Chapter 2: Understanding randomness and random numbers



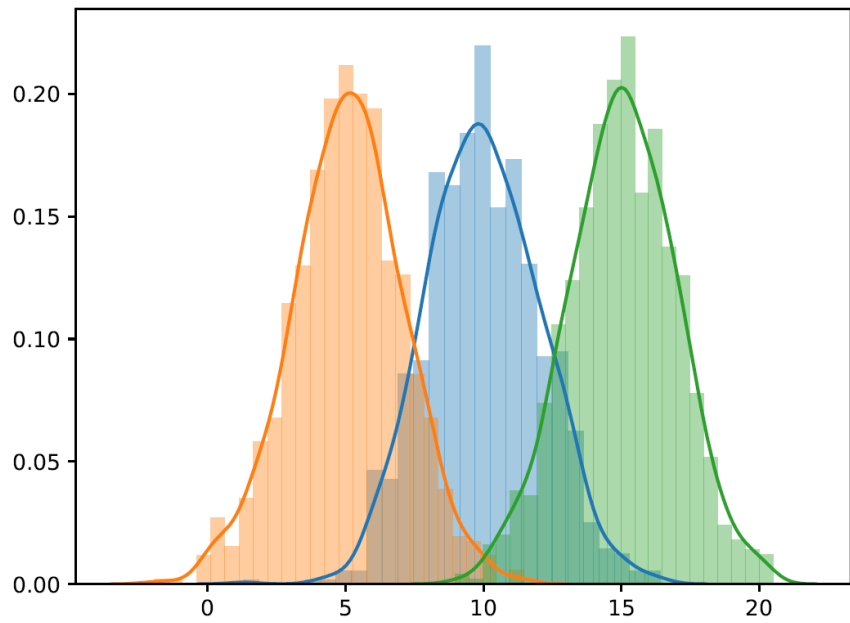
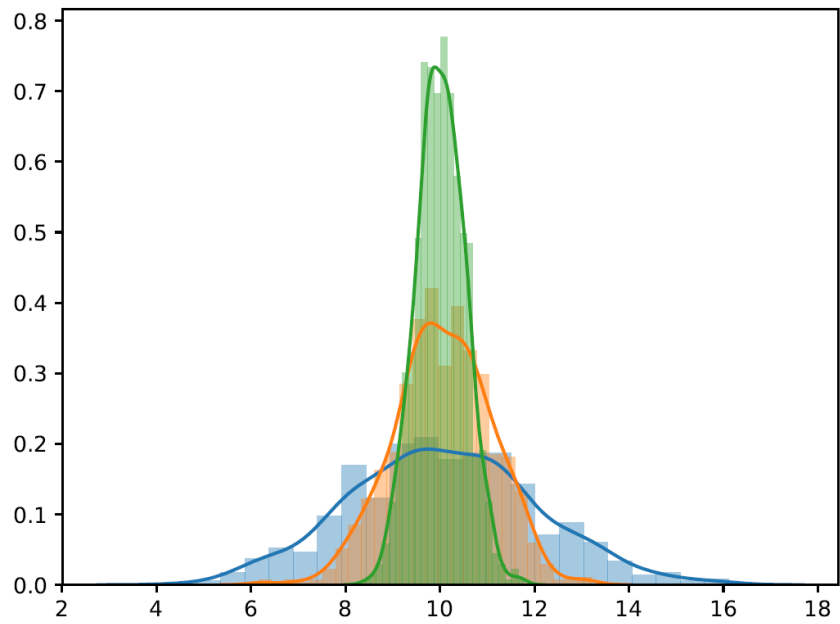
d.f.	.995	.99	.975	.95	.9	.1	.05	.025	.01
1	0.00	0.00	0.00	0.00	0.02	2.71	3.84	5.02	6.63
2	0.01	0.02	0.05	0.10	0.21	4.61	5.99	7.38	9.21
3	0.07	0.11	0.22	0.35	0.58	6.25	7.81	9.35	11.34
4	0.21	0.30	0.48	0.71	1.06	7.78	9.49	11.14	13.28
5	0.41	0.55	0.83	1.15	1.61	9.24	11.07	12.83	15.09
6	0.68	0.87	1.24	1.64	2.20	10.64	12.59	14.45	16.81
7	0.99	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21
11	2.60	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.72
12	3.07	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22
13	3.57	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69
14	4.07	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14
15	4.60	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58
16	5.14	5.81	6.91	7.96	9.31	23.54	26.30	28.85	32.00
17	5.70	6.41	7.56	8.67	10.09	24.77	27.59	30.19	33.41
18	6.26	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81
19	6.84	7.63	8.91	10.12	11.65	27.20	30.14	32.85	36.19
20	7.43	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57

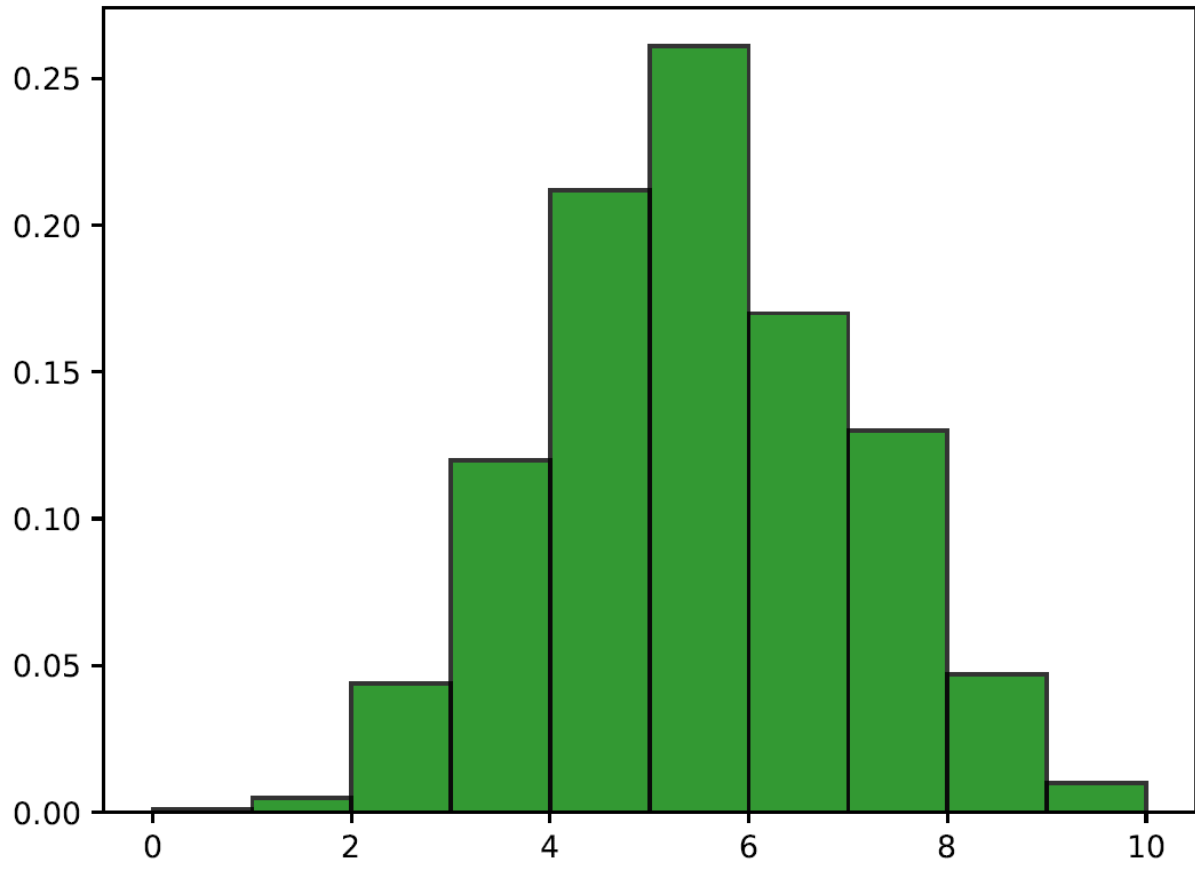


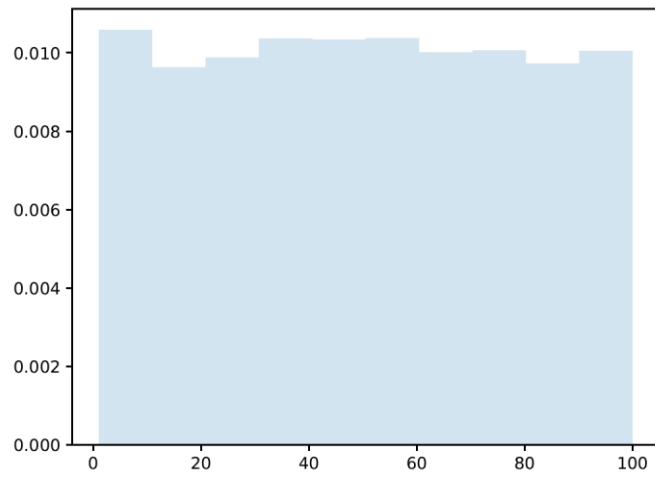
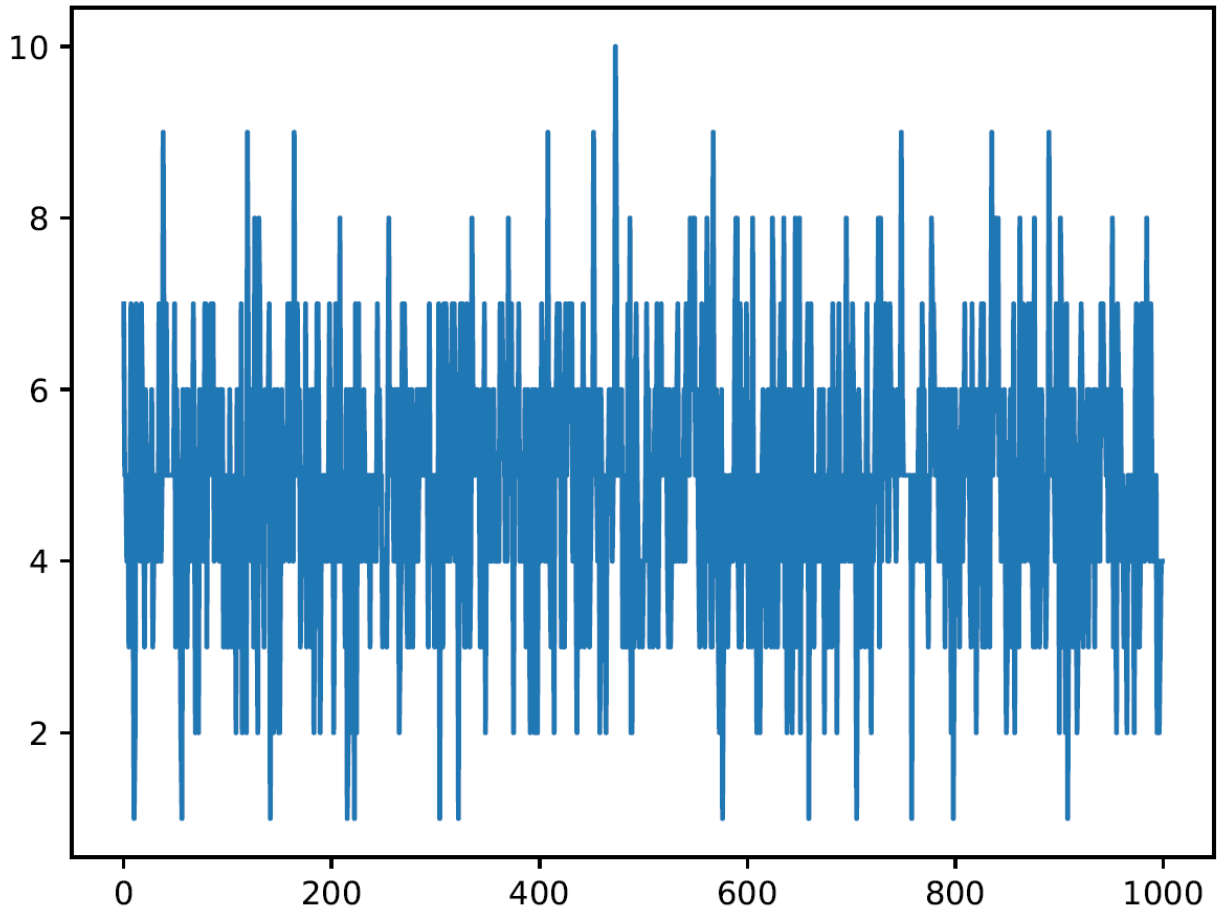
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0.0005893525670232962	0.08411602260736563	0.48777336836223184	0.43658181719322775
0.044201442526747216	0.30870169275845477	0.5830026104035799	0.743636274590919
0.3151081876433958	0.15262694570823895	0.7251957597793991	0.7727205682418871
0.6331140620788159	0.44702092252998654	0.38968195830922664	0.9540425911331748
0.4835546335594517	0.526569173916508	0.22614685922216013	0.5531943014604944
0.26659750019507367	0.49268802511165294	0.9610144342114285	0.489572589979308
0.9948125053172989	0.9516018666101629	0.07608253232952325	0.7179442316842937
0.6109378643384845	0.3701399622345995	0.7061899219202762	0.8458173511763184
0.8203398039659205	0.7604971545564463	0.9642441198063288	0.4363013084215584
0.525485268573037	0.03728656472511895	0.3183089519470506	0.7225981167157172
0.4113951243513241	0.7964923534525988	0.873171384852925	0.19485872853307926
0.8546343123794693	0.7369264810052358	0.4878538332357322	0.6144046334616862
0.09757339865787579	0.26948604931565284	0.5890374759161088	0.08034748820604173
0.3180048956153937	0.21145368936073672	0.17781067321906363	0.02606161265916266
0.8503671599786575	0.8590266946046737	0.33580048491051445	0.954620948505877
0.7775369685969953	0.4270020655482086	0.1850363561813889	0.5965711044131644
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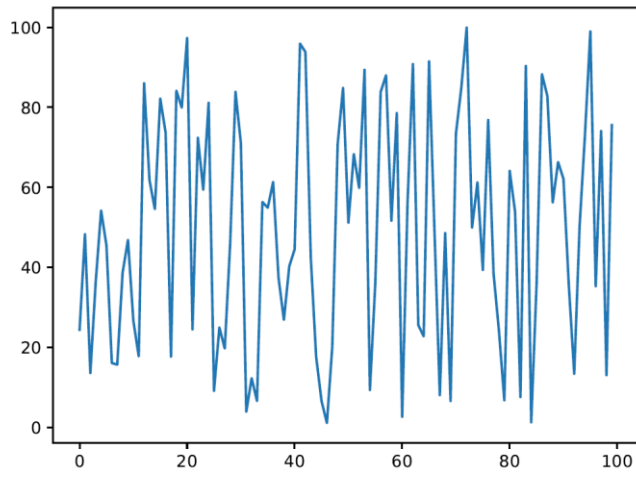
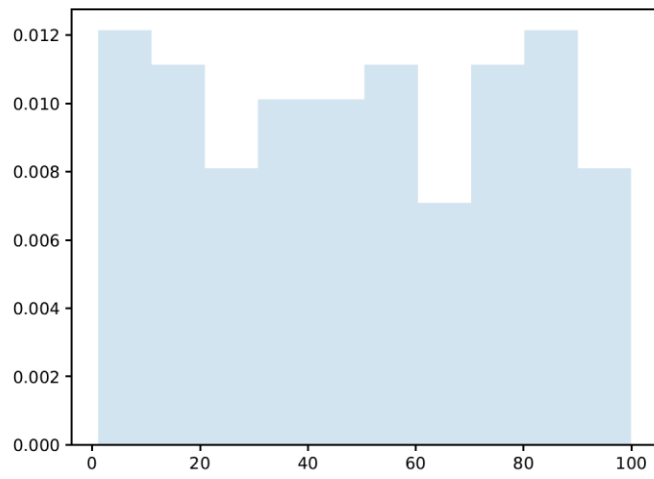
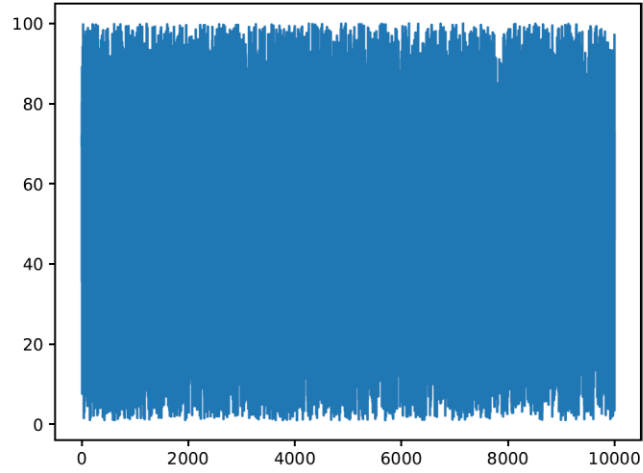


### Chapter 3: Probability and Data Generating Process

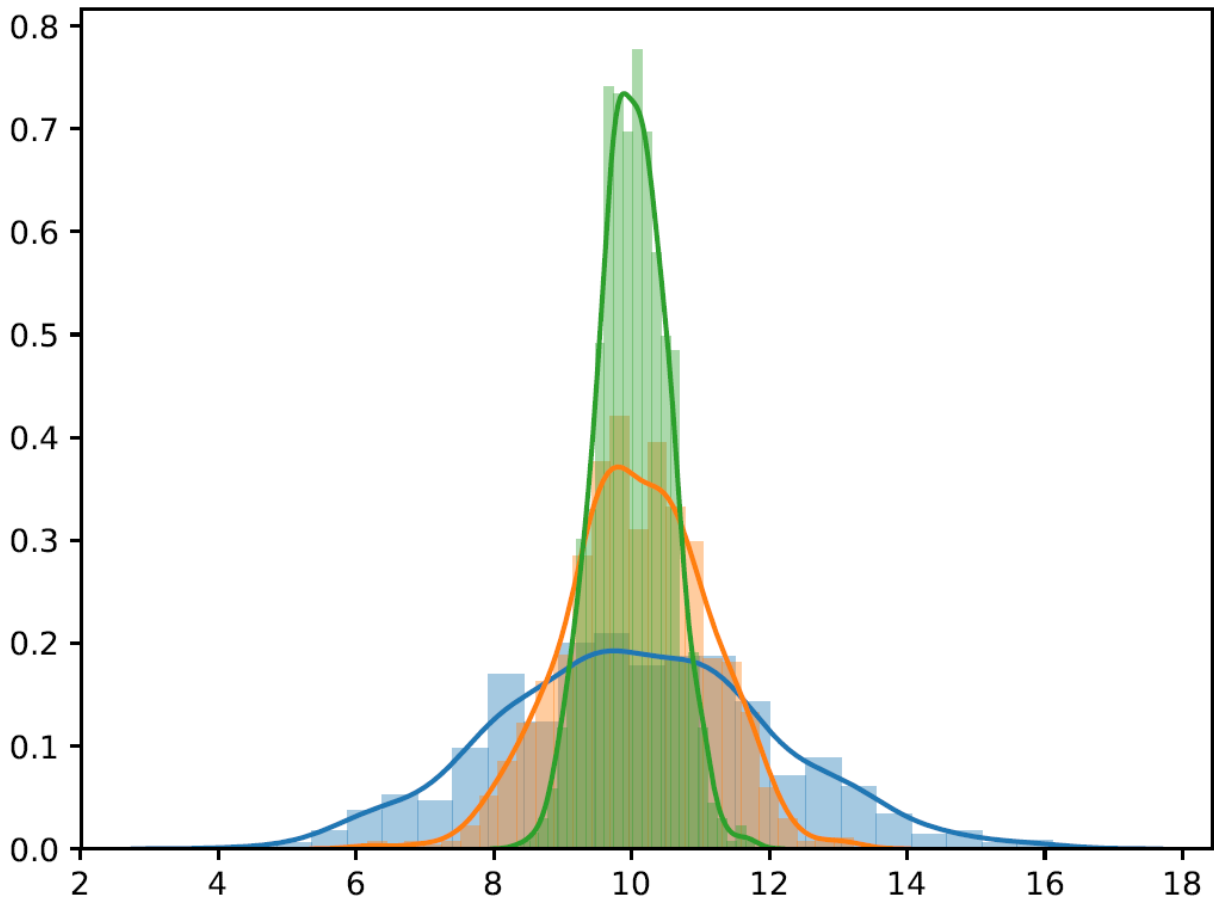
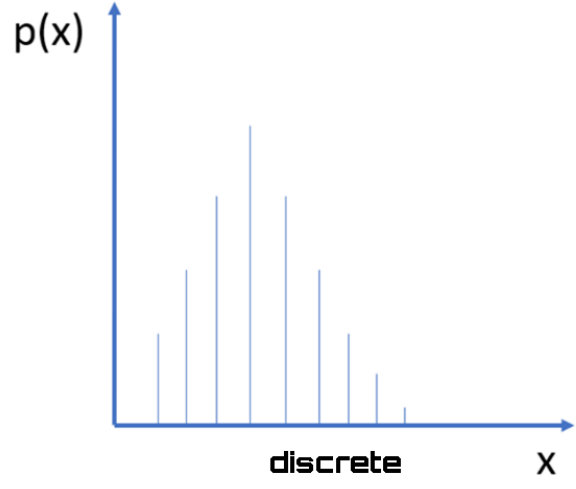
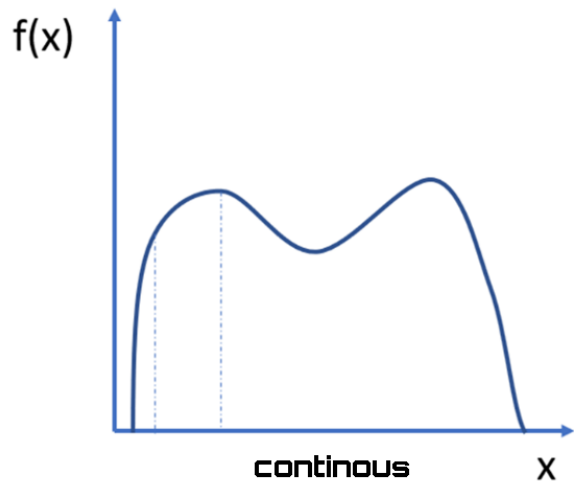


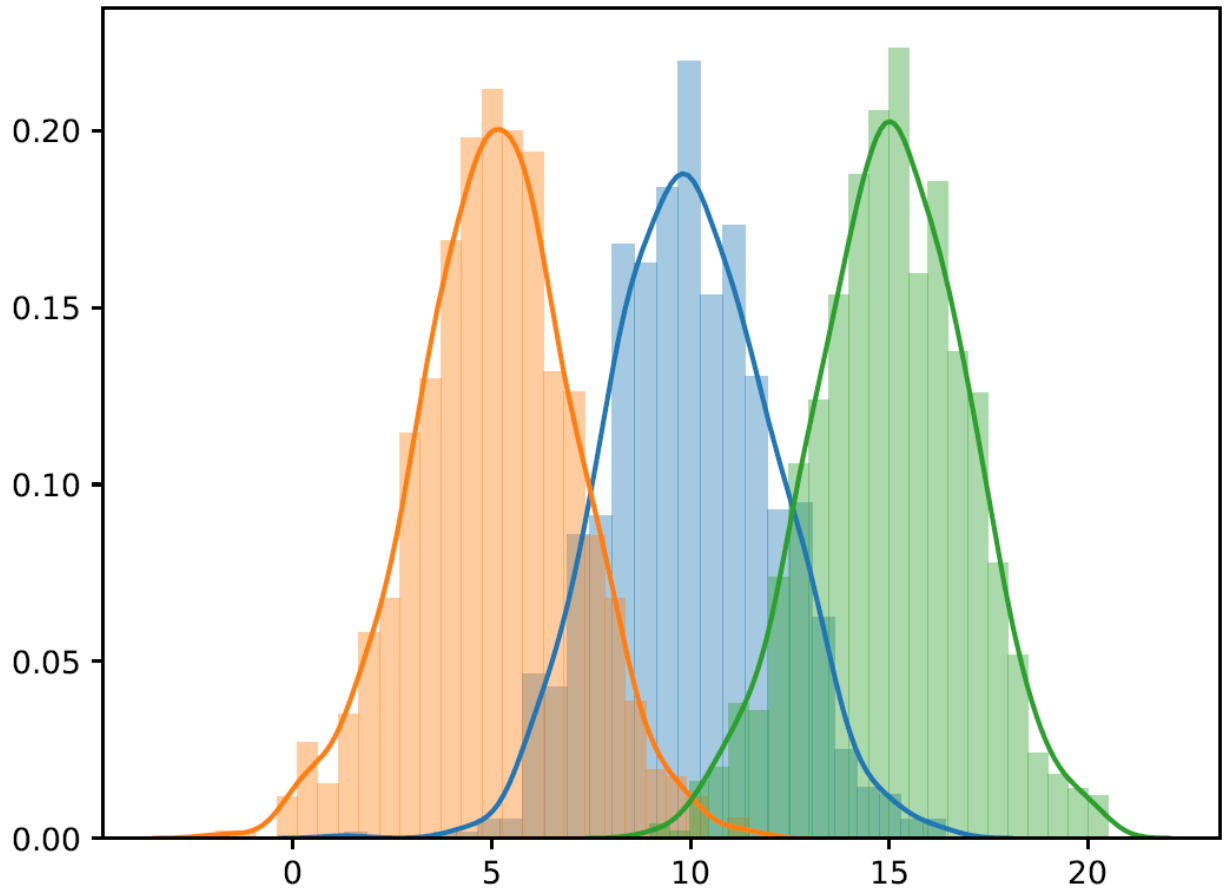


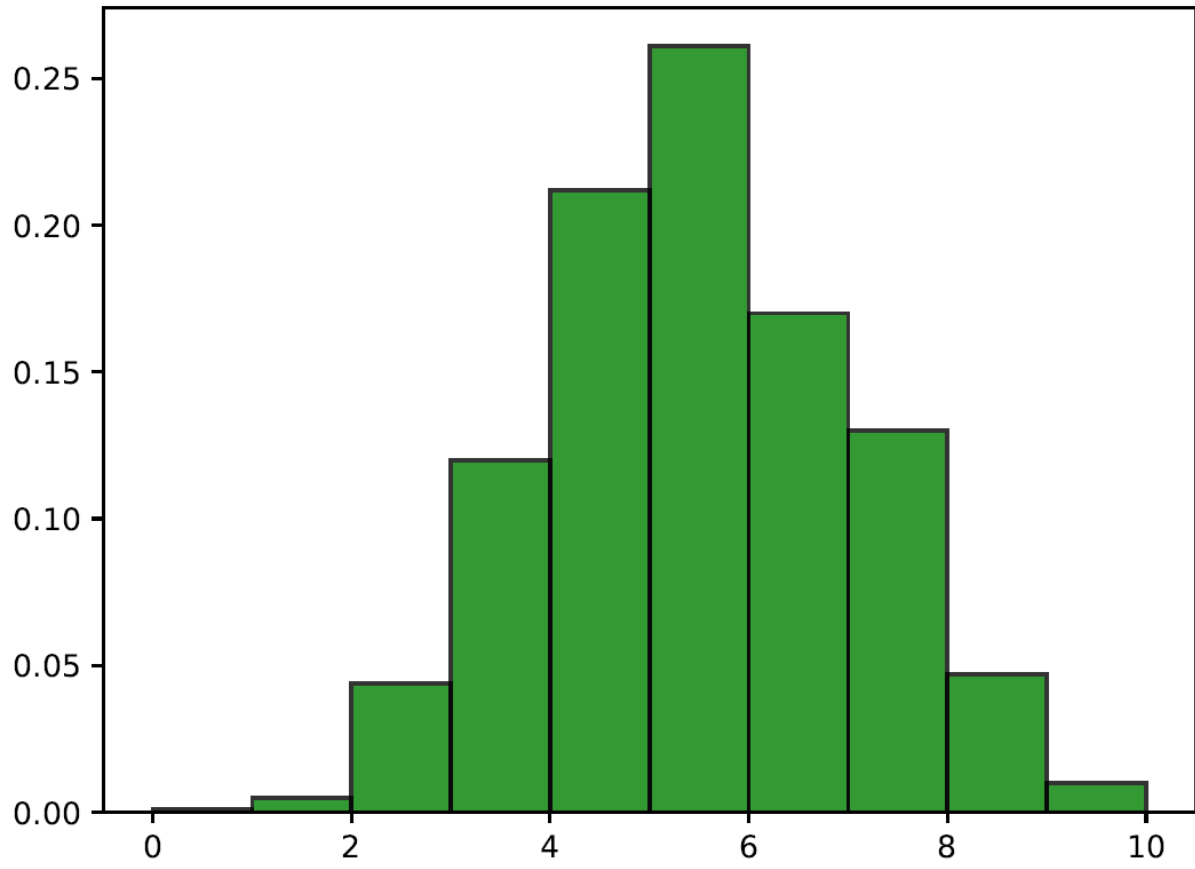


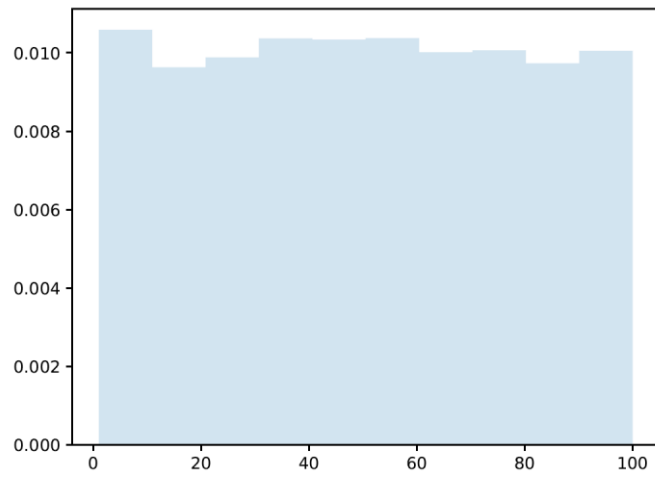
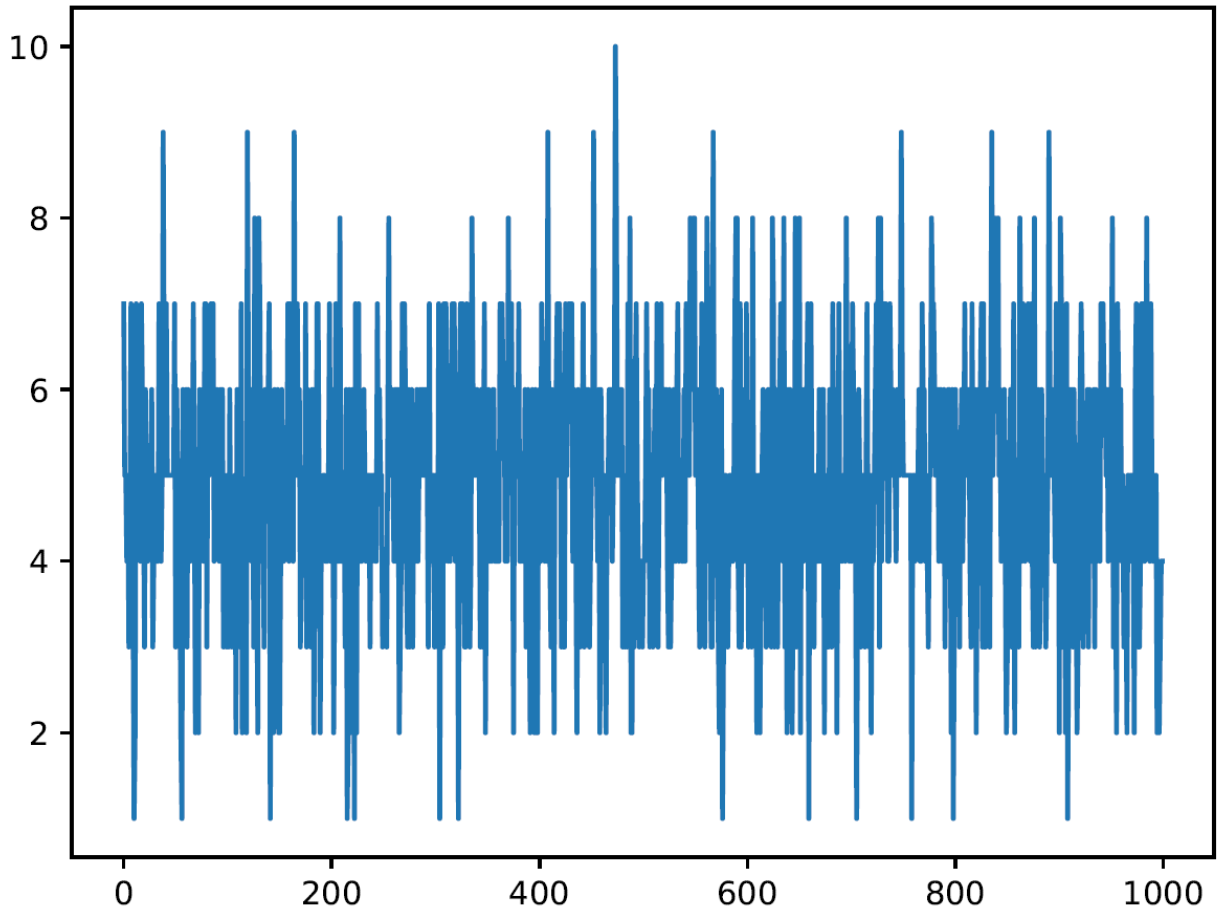


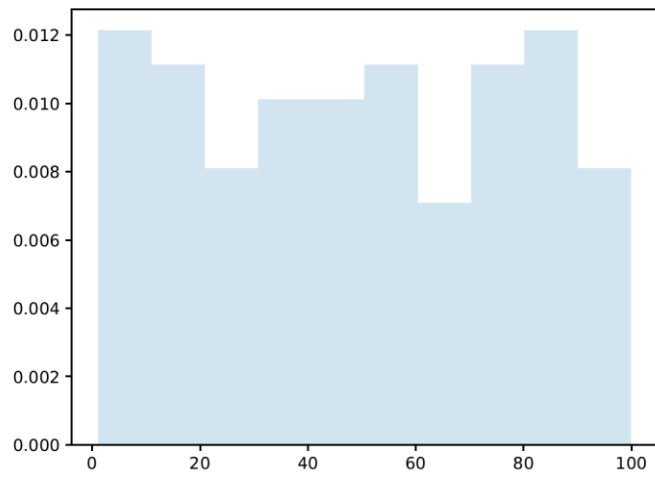
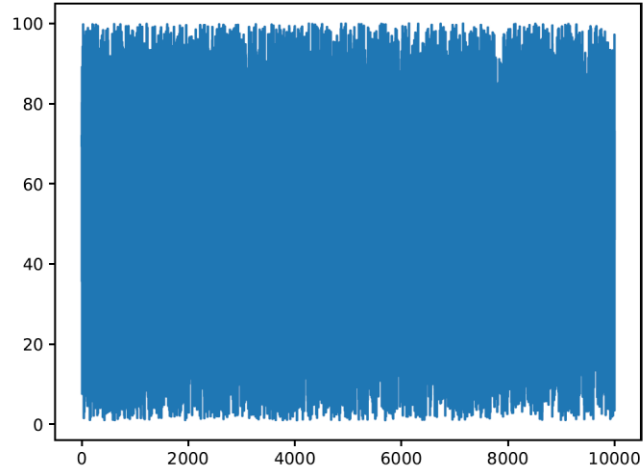


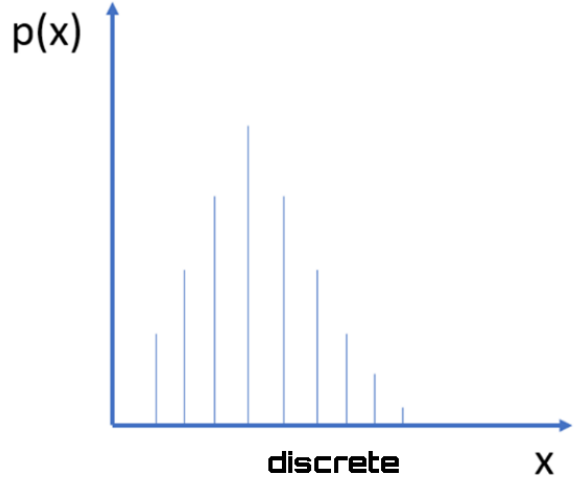
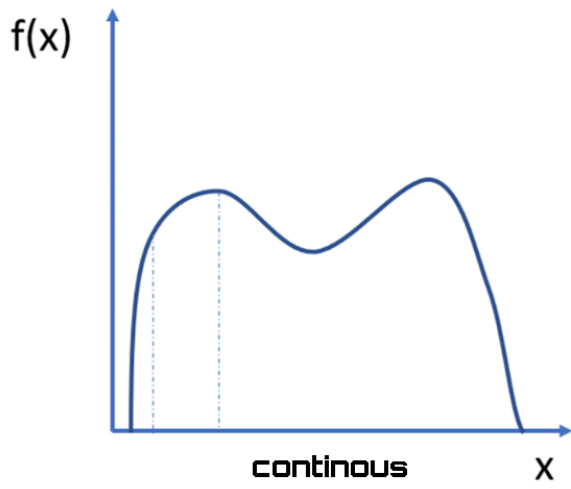
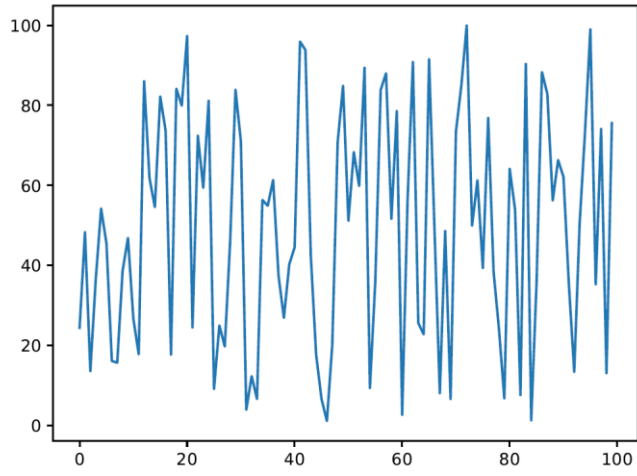




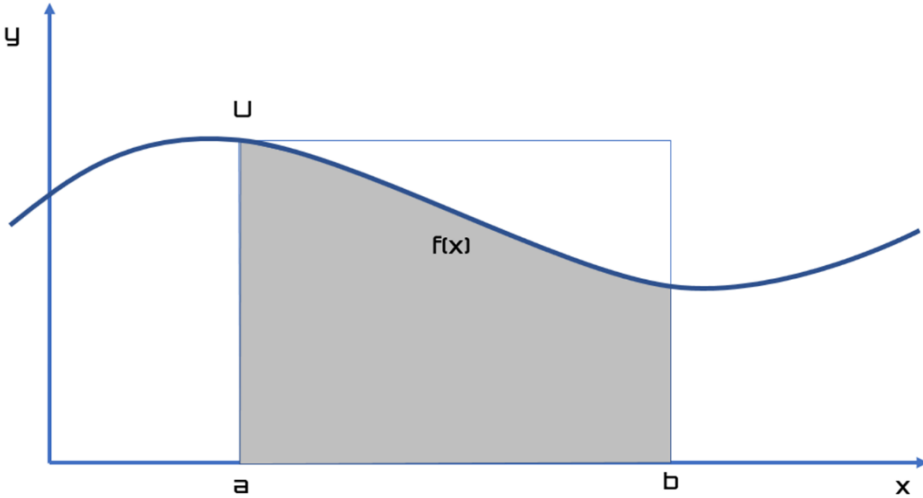
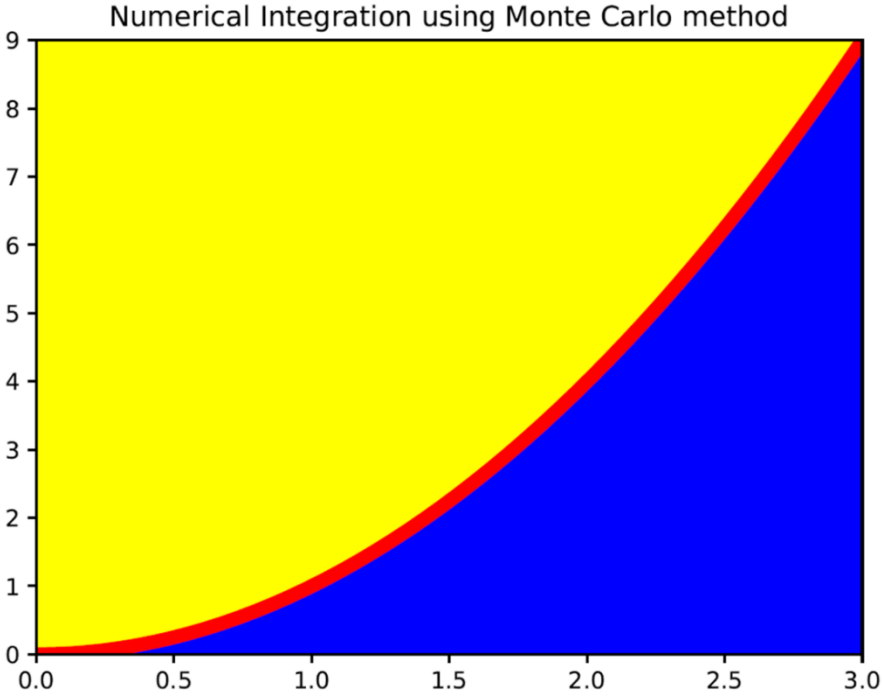


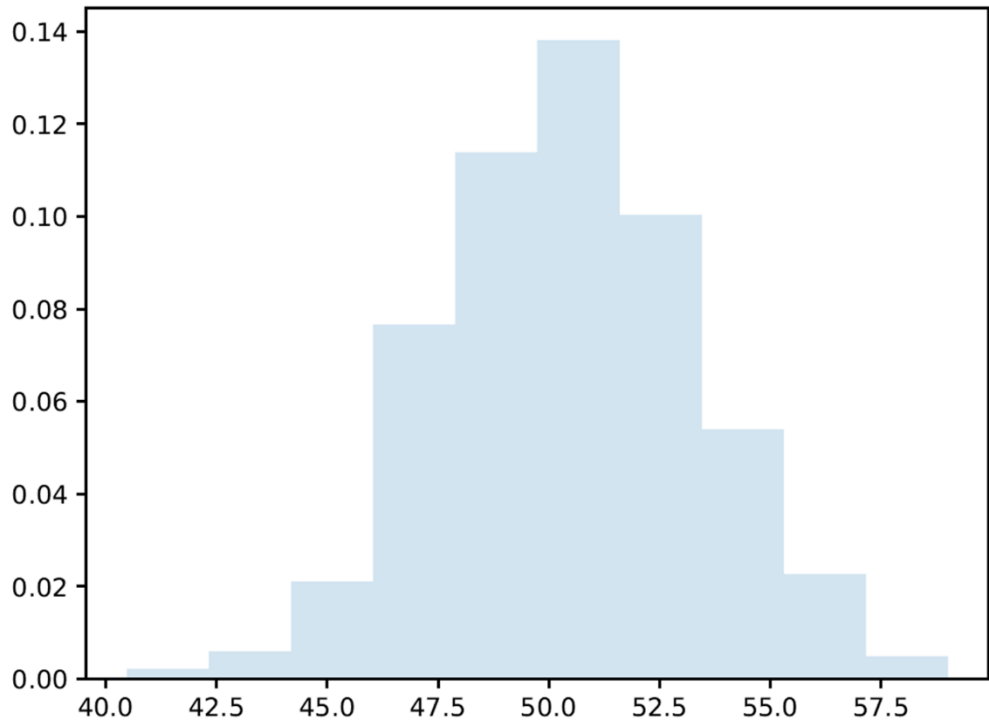
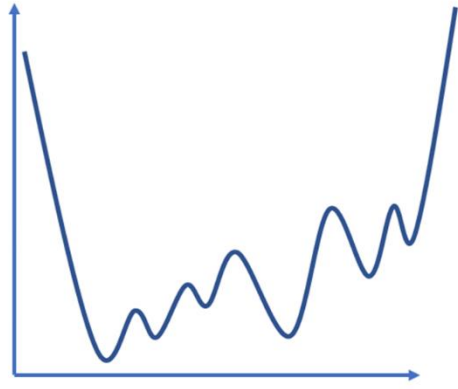
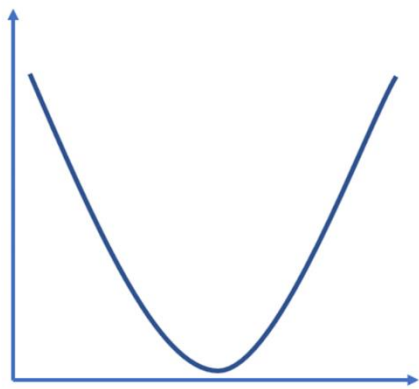




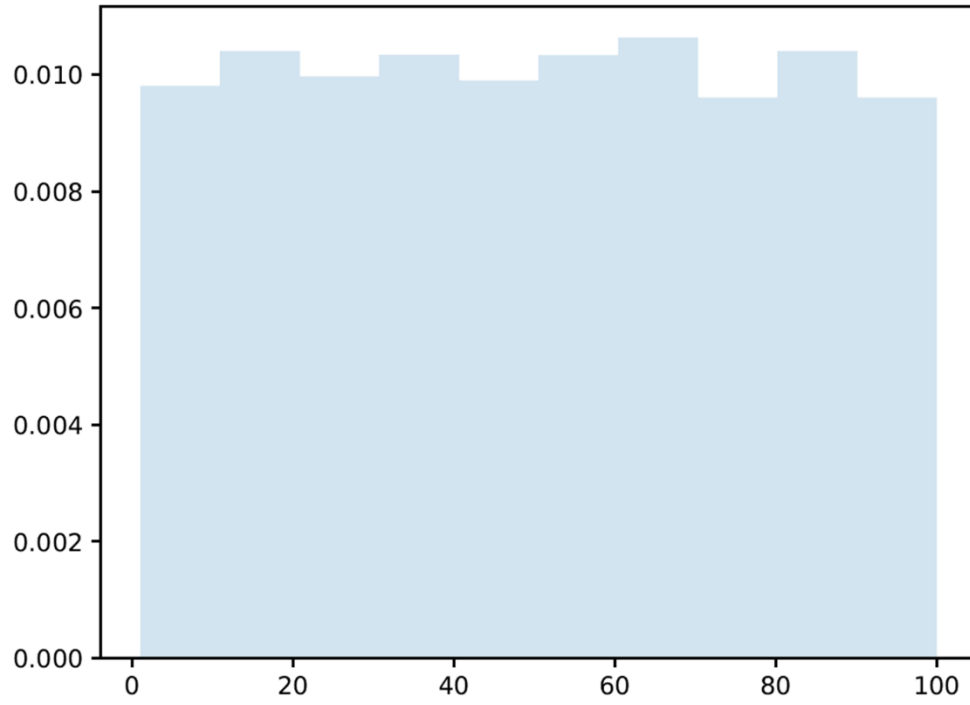


# Chapter 4: Exploring Monte Carlo Simulations

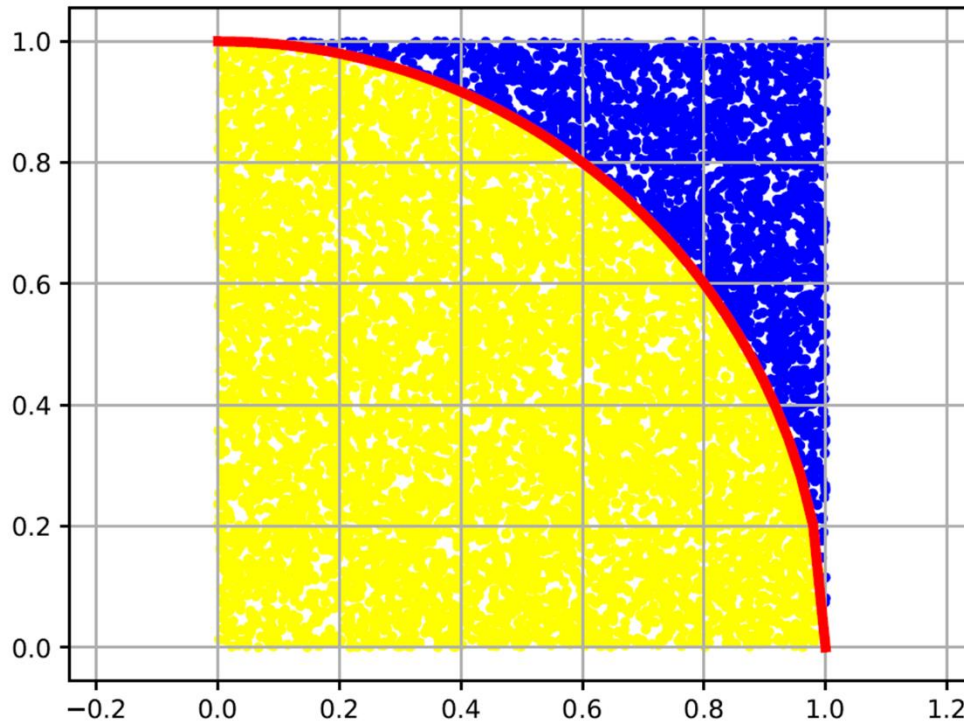


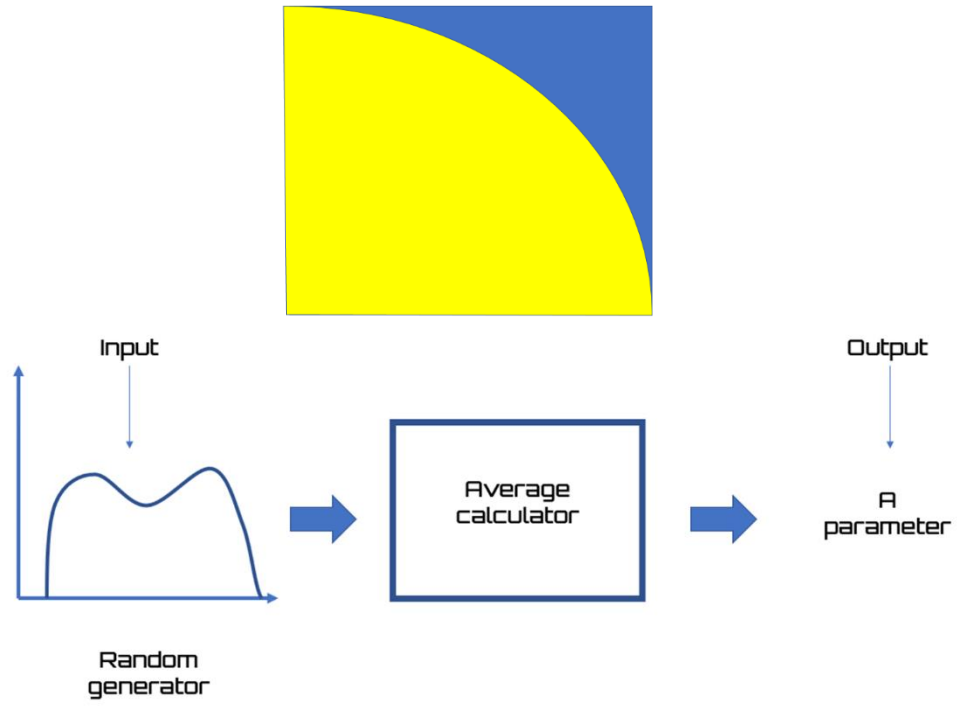




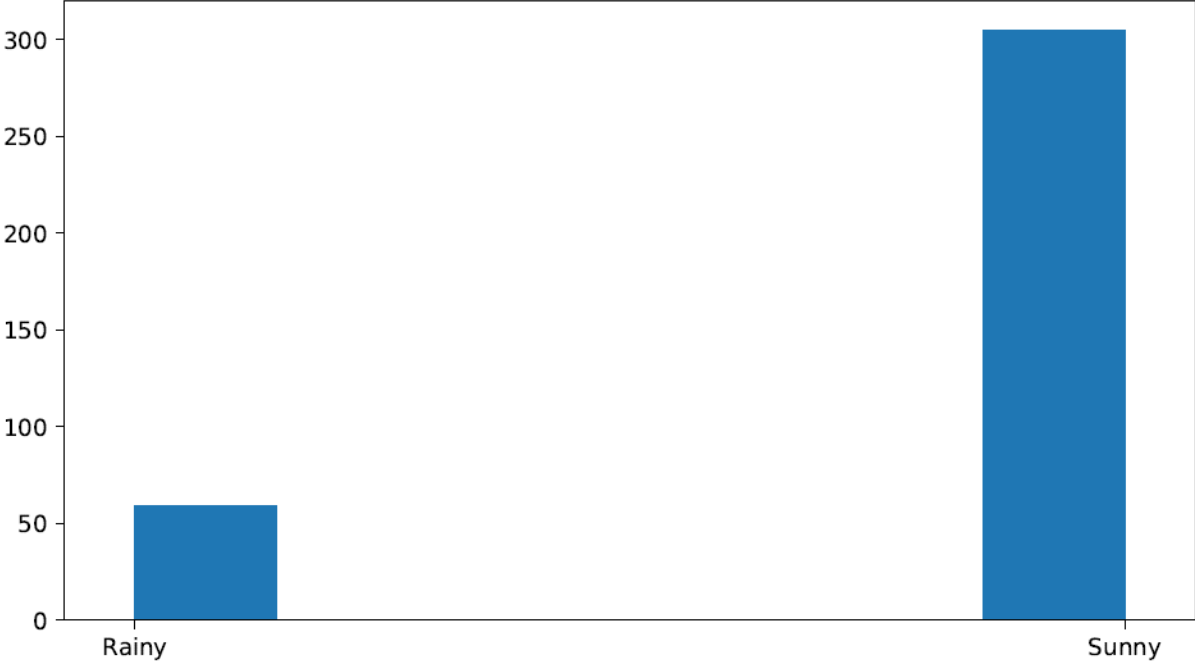
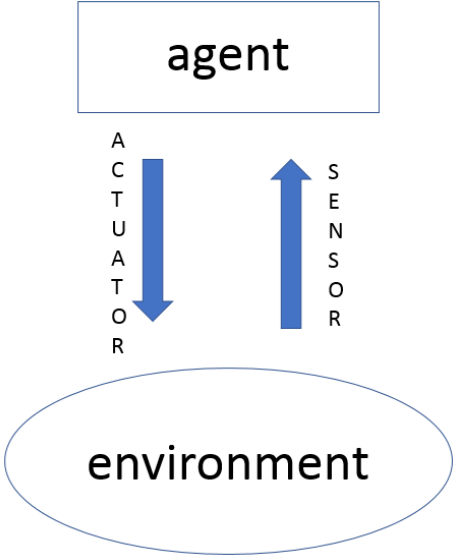


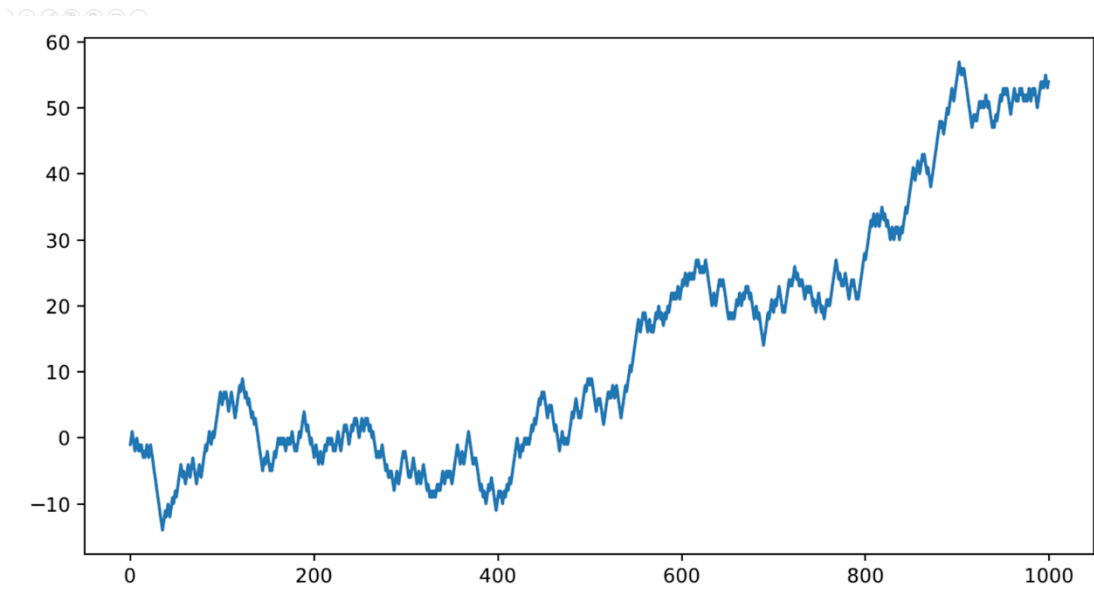
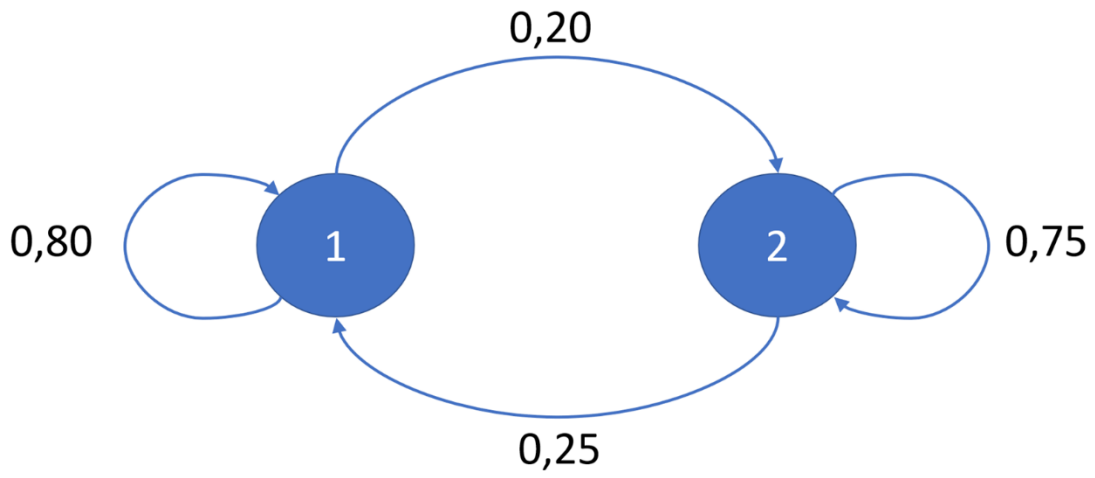
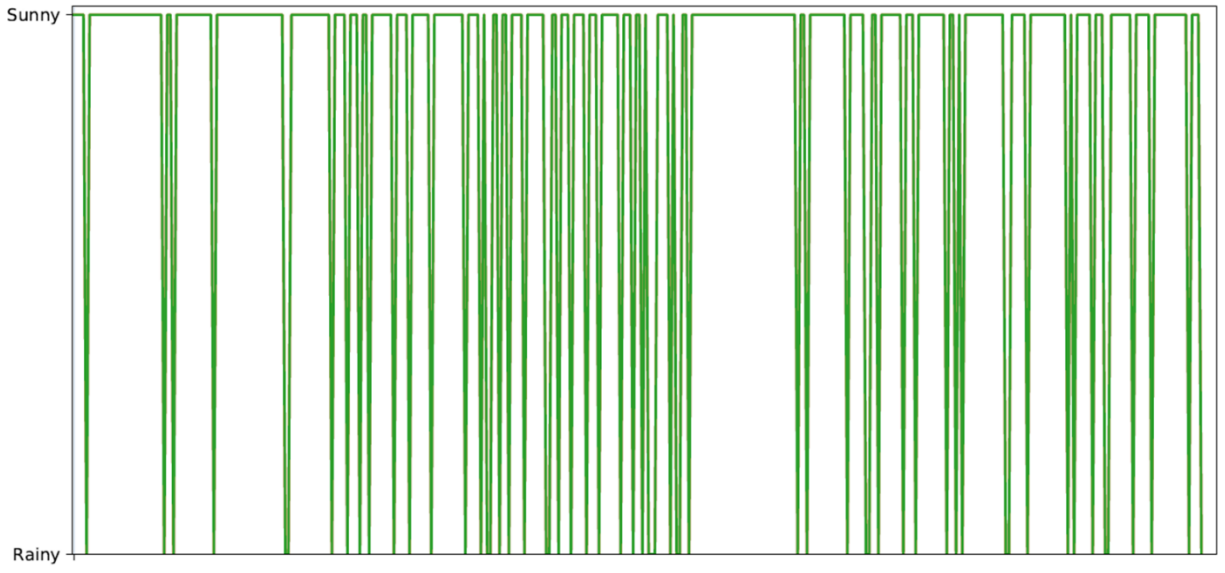
Monte Carlo method for Pi estimation

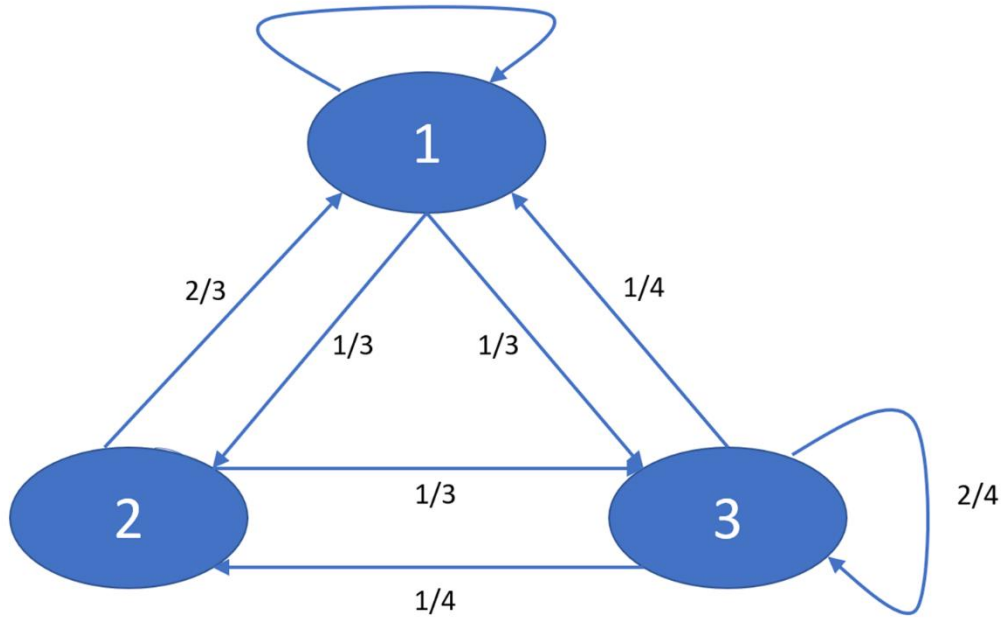
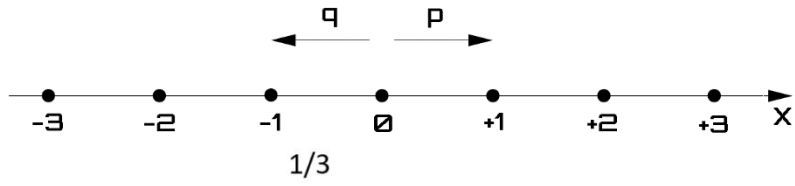


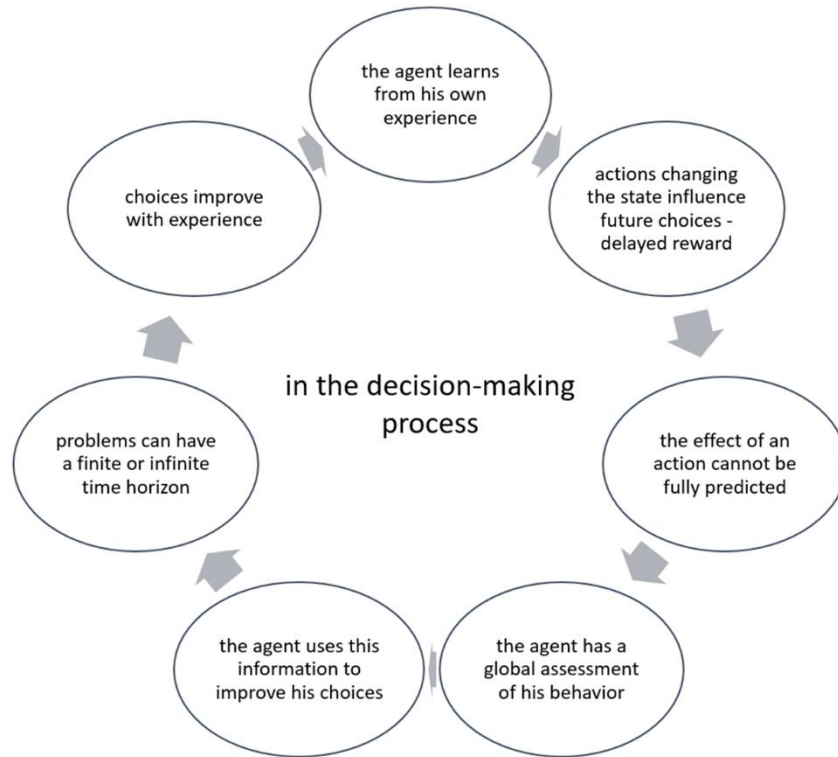
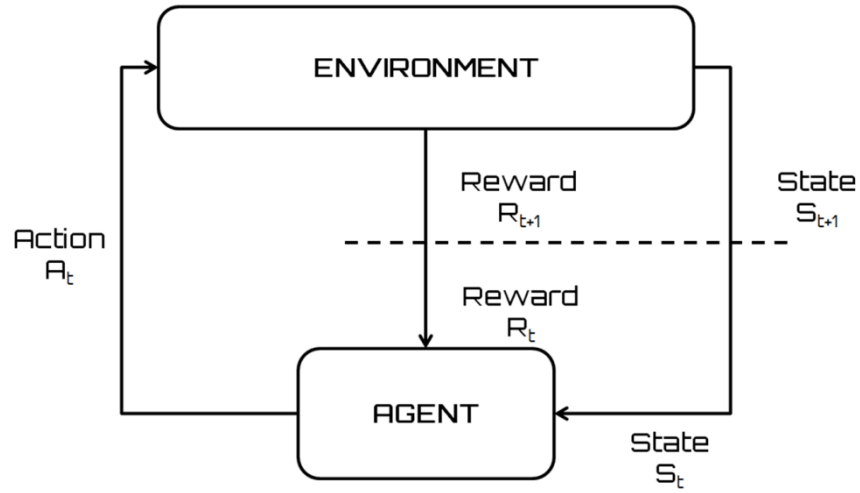


# Chapter 5: Simulation-Based Markov Decision Process

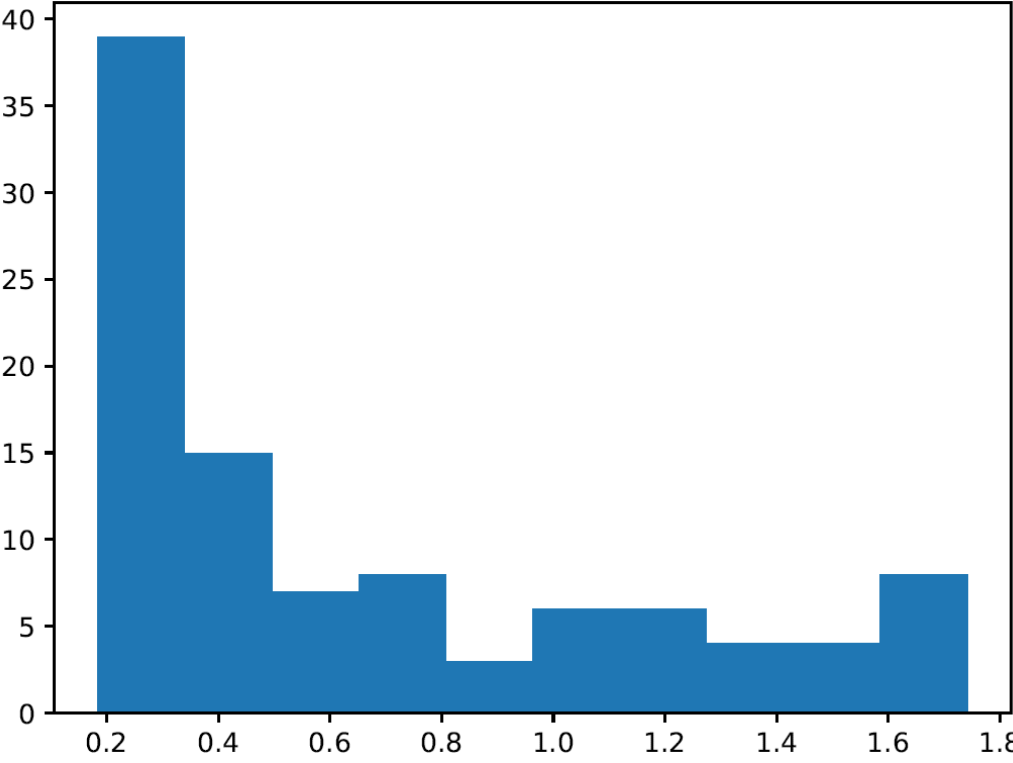
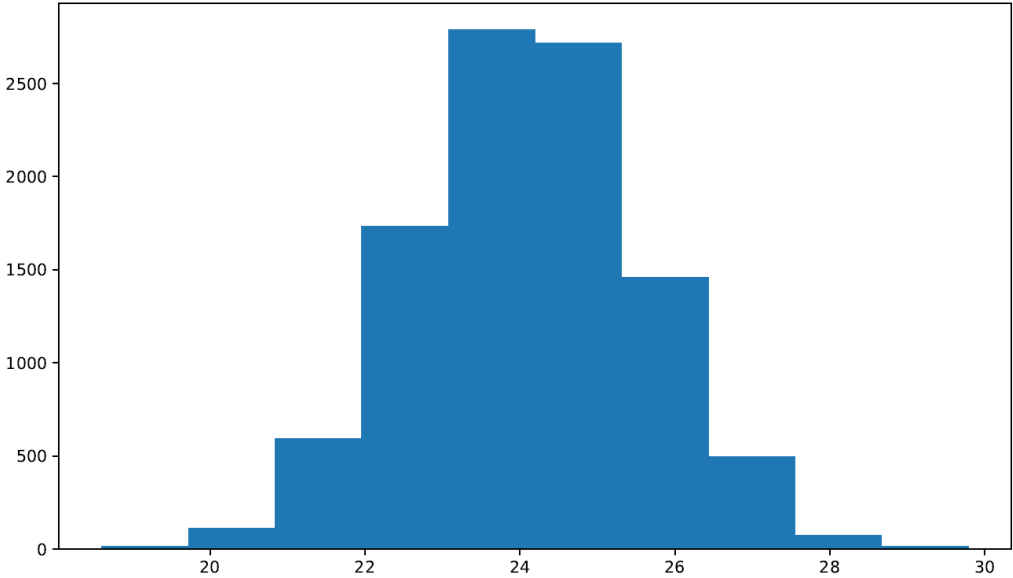


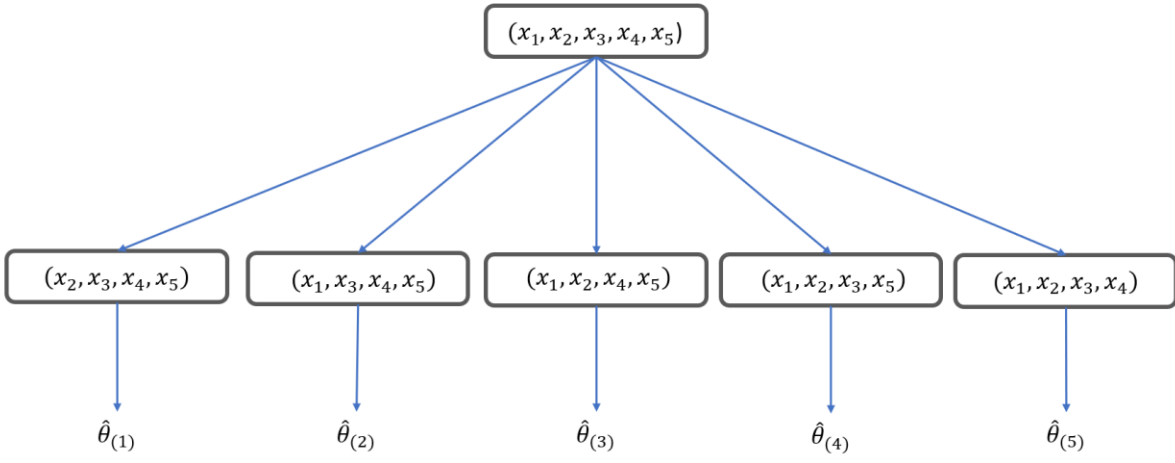






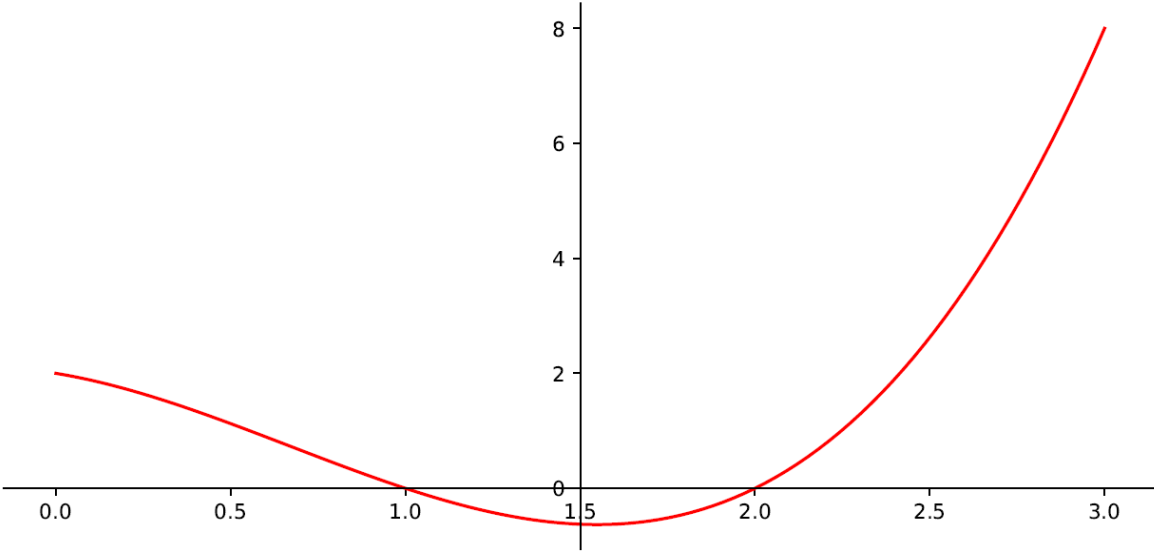
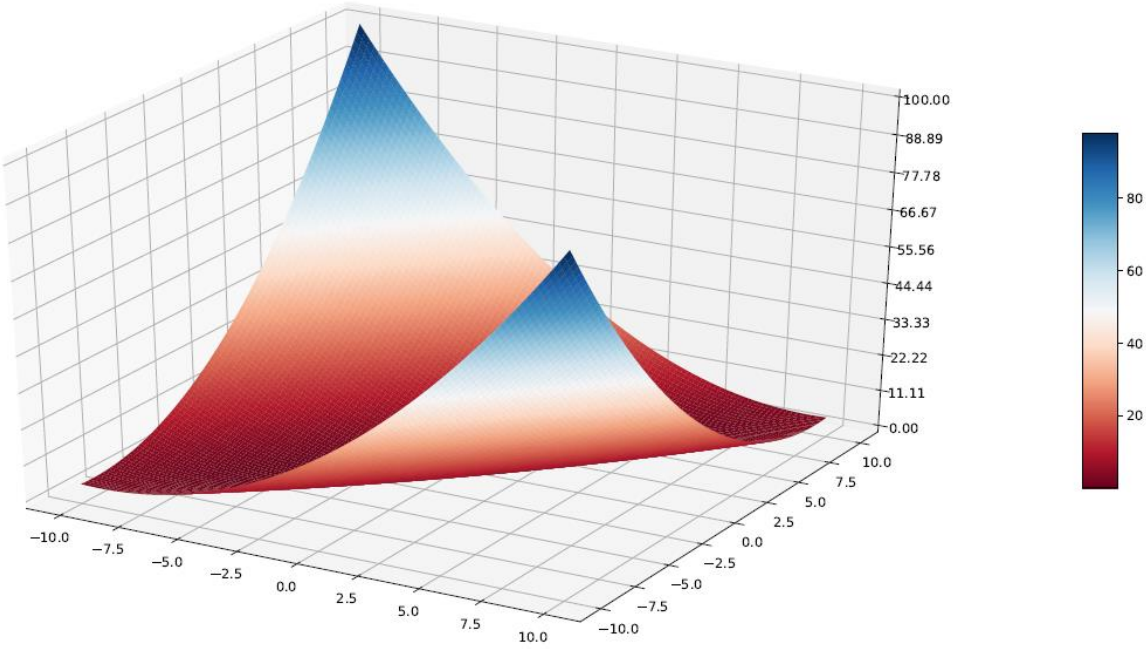
# Chapter 6: Resampling methods

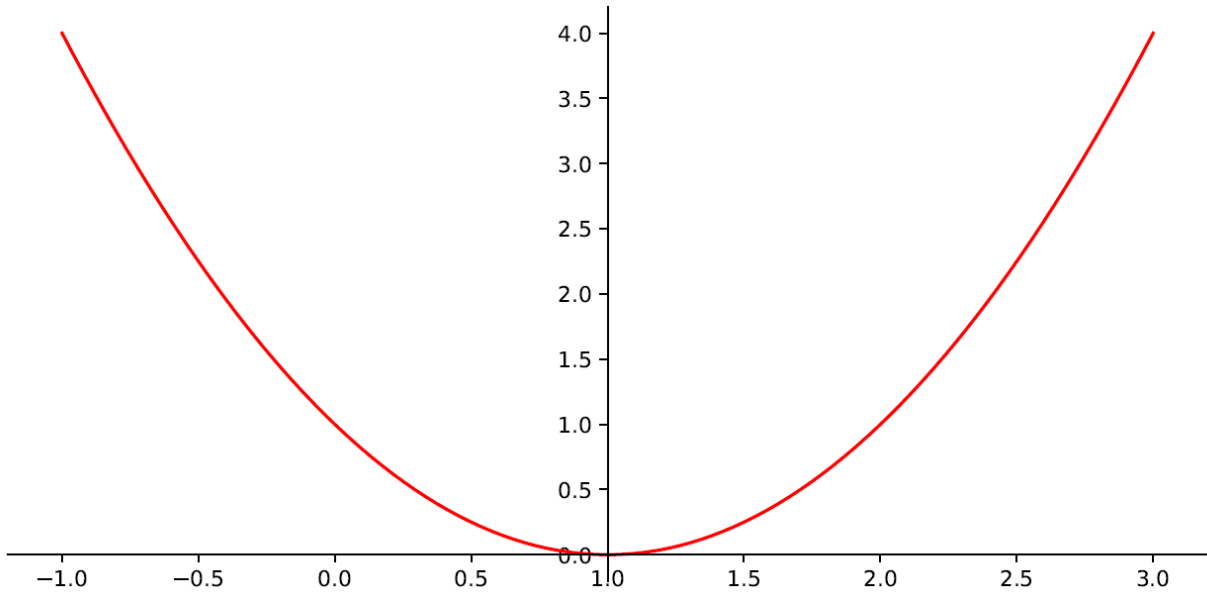
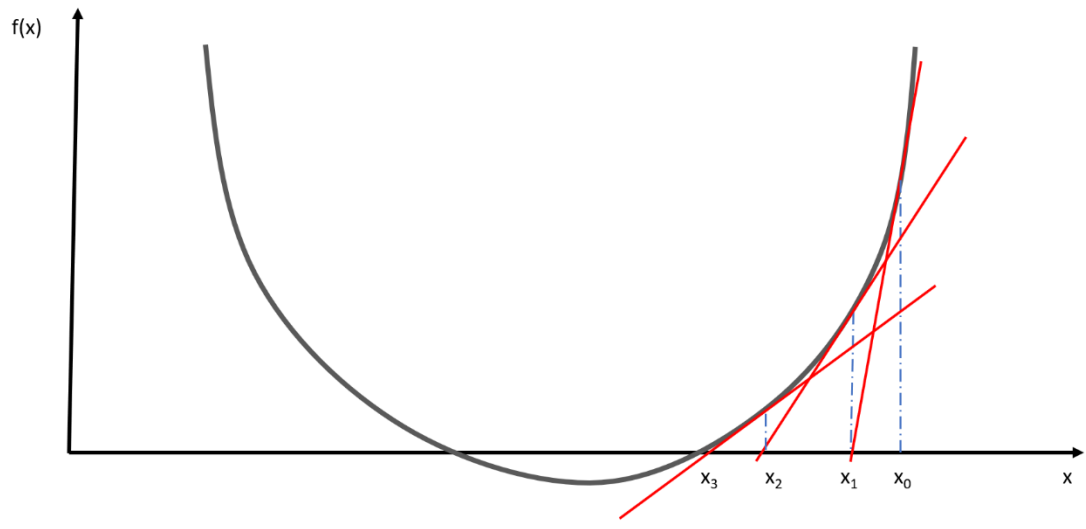


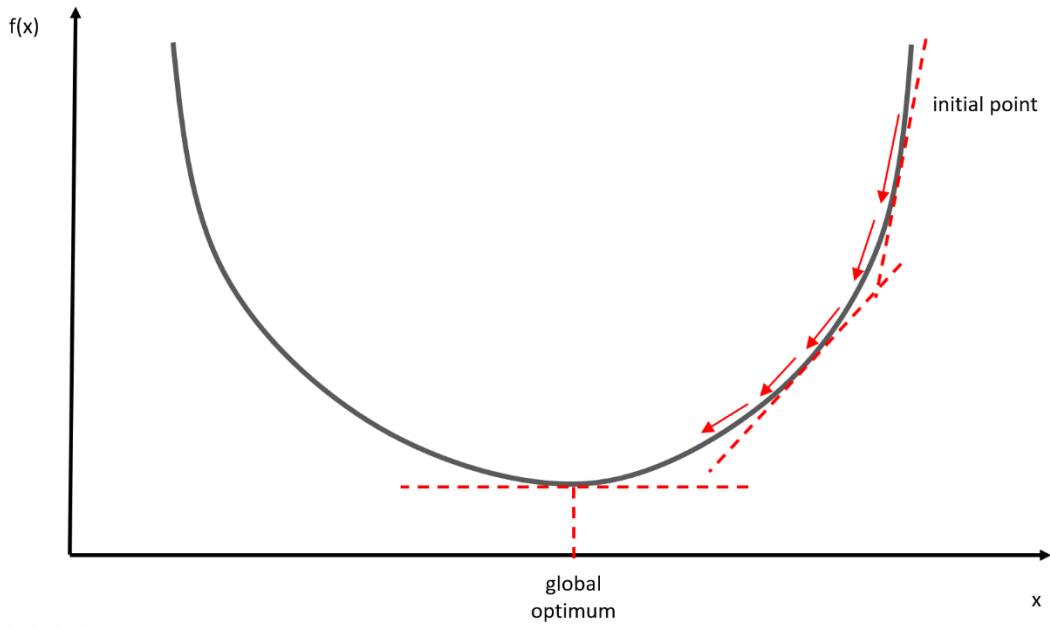
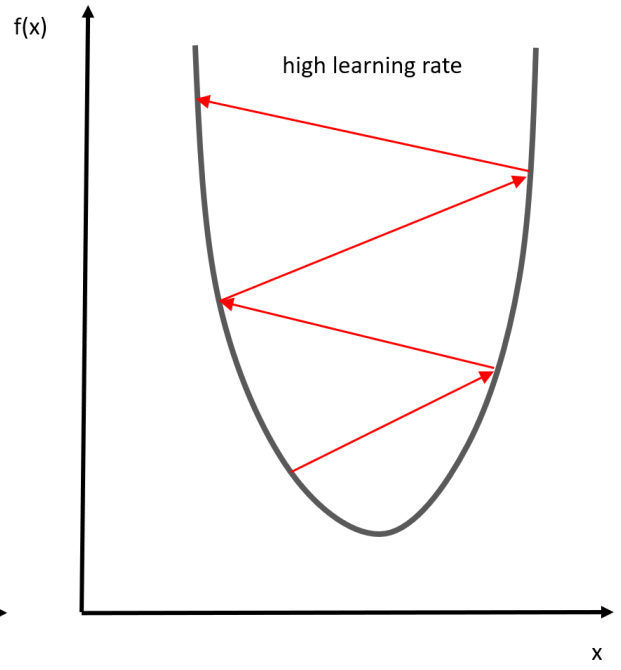
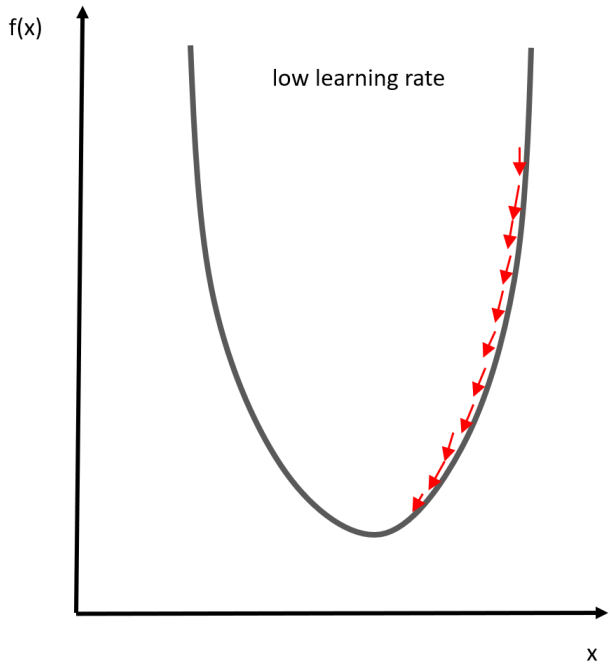


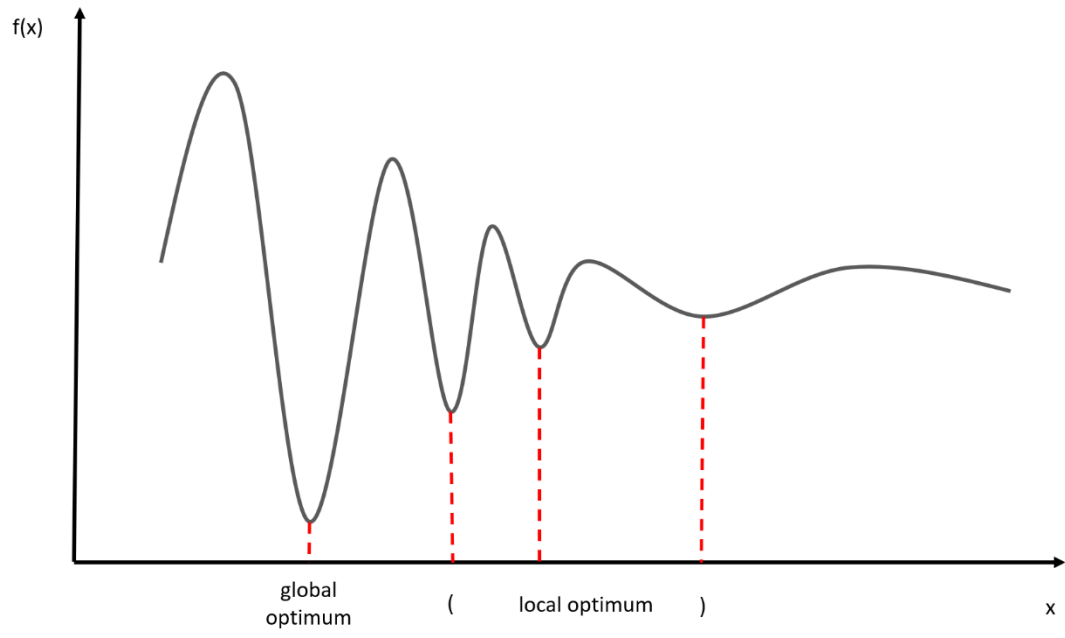


# Chapter 7: Using Simulations to Improve and Optimize Systems



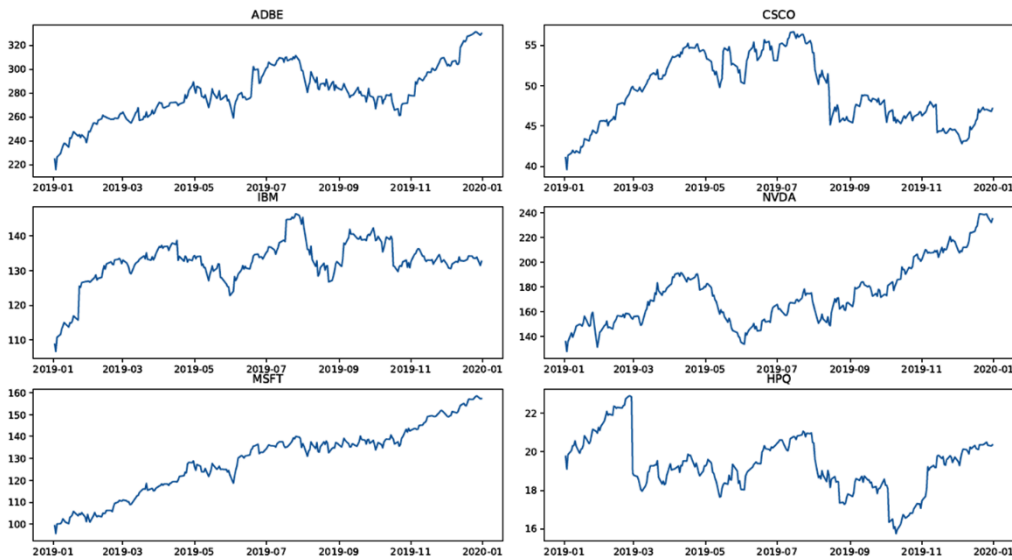




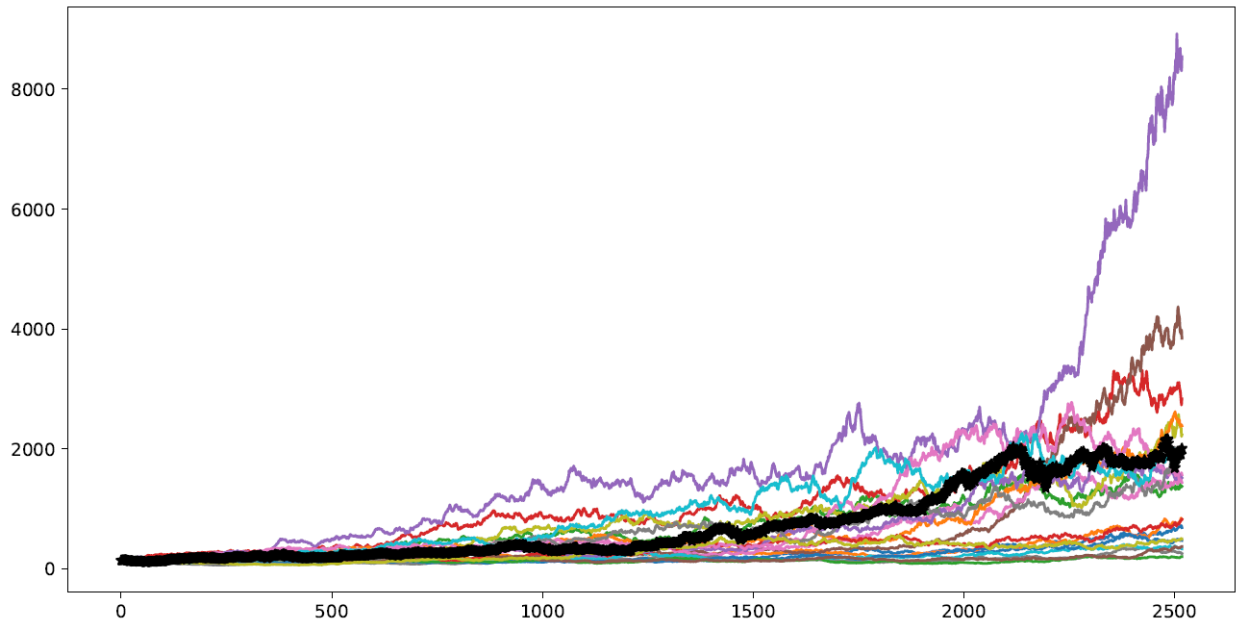
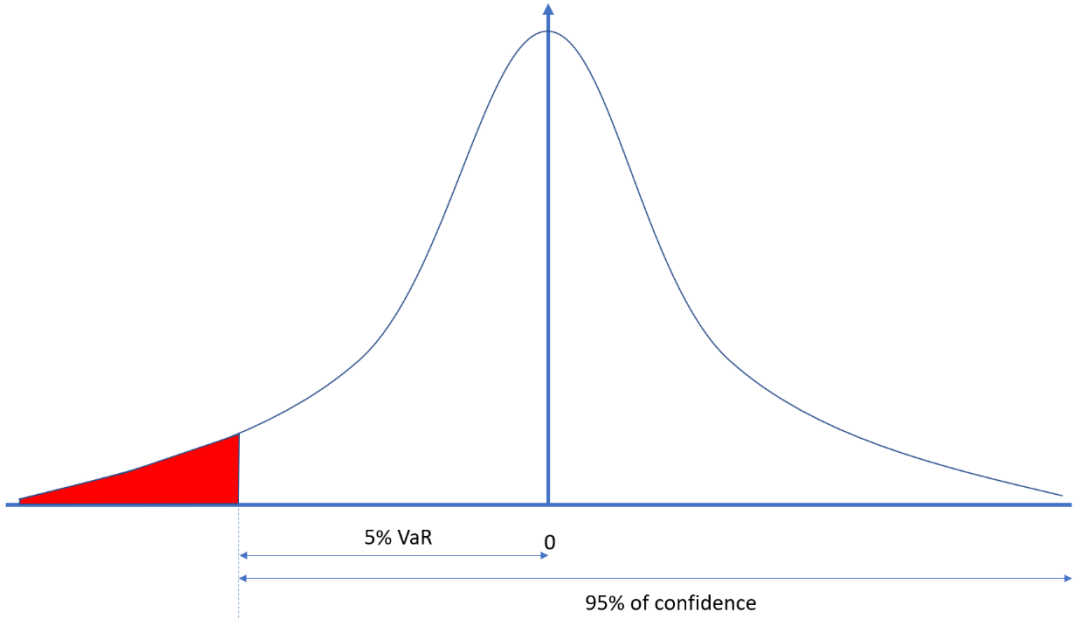


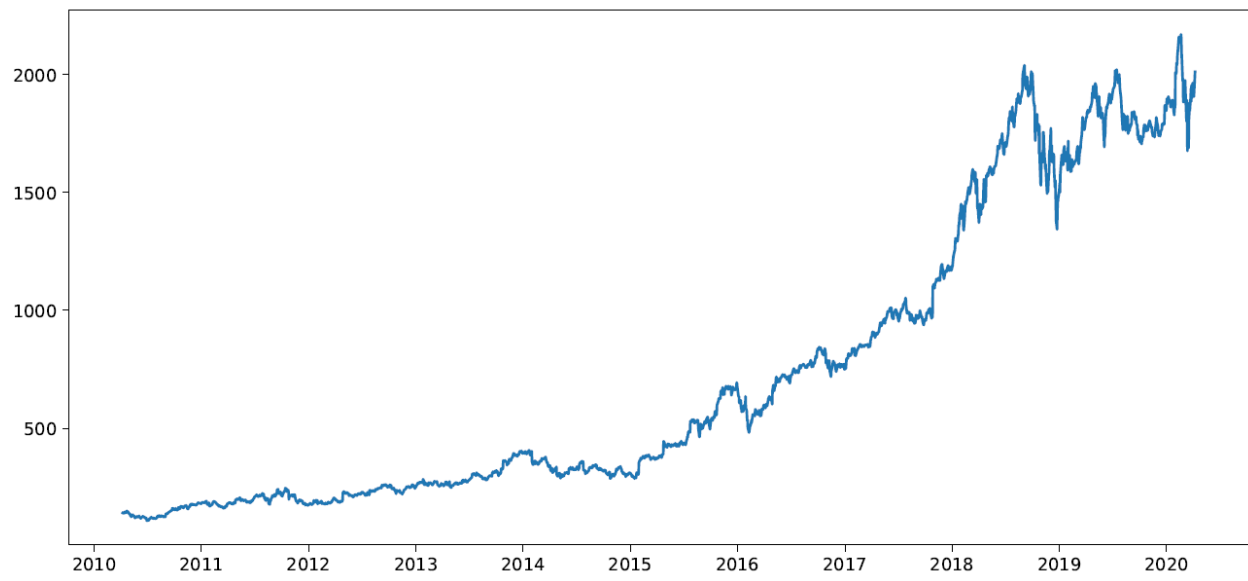
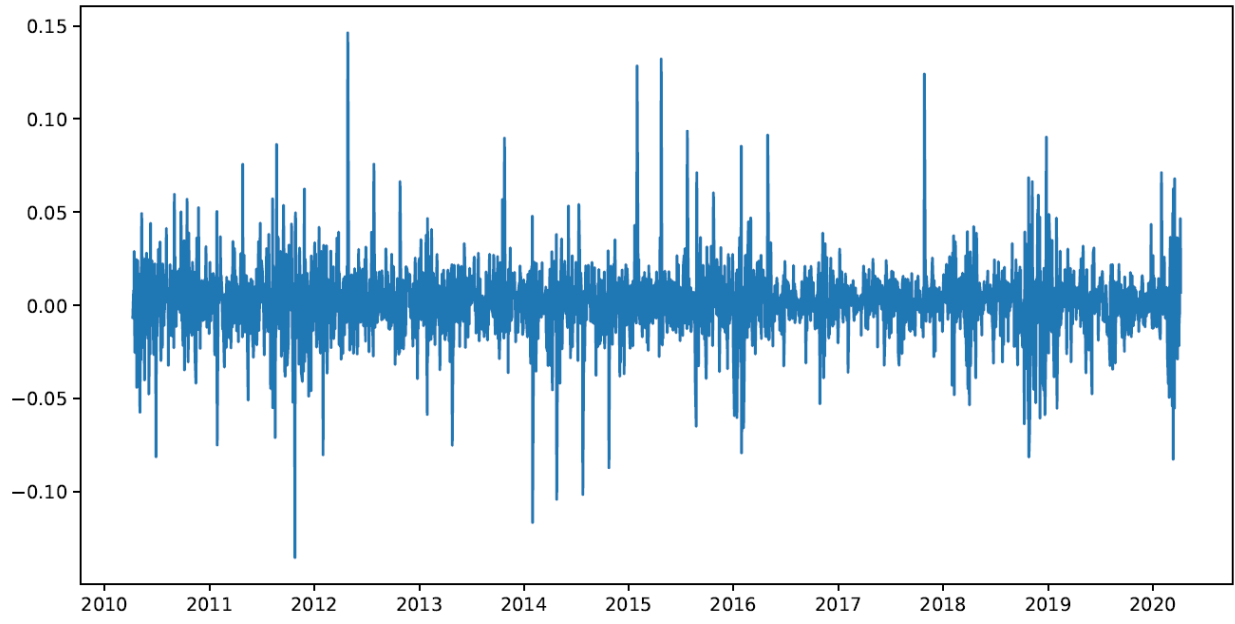
## Chapter 8: Using Simulation Models for Financial Engineering

Date	ADBE	CSCO	HPQ	IBM	MSFT	NVDA
2019-12-10	-0.009379	0.004556	-0.004622	-0.000075	-0.001520	0.008531
2019-12-11	-0.001414	0.004082	-0.006436	-0.001120	0.003772	0.015702
2019-12-12	0.007309	0.031391	0.017937	0.011663	0.010152	0.030965
2019-12-13	0.039155	-0.008102	-0.003916	-0.008203	0.008418	-0.000357
2019-12-16	0.018431	0.015011	0.008354	-0.000596	0.006471	0.005179
2019-12-17	-0.002934	0.010004	-0.007310	0.000671	-0.005401	0.013946
2019-12-18	0.004739	0.004307	-0.001964	0.001416	-0.002069	0.005344
2019-12-19	0.010019	0.026587	-0.001476	0.001116	0.008680	0.025925
2019-12-20	-0.000061	-0.008981	0.012808	0.007655	0.010918	0.016606
2019-12-23	0.004090	0.013699	0.000000	-0.000295	0.000000	-0.002298
2019-12-24	0.002098	-0.006653	0.001459	-0.004205	-0.000191	-0.000837
2019-12-26	0.004732	0.001465	0.004857	-0.000519	0.008197	0.002389
2019-12-27	-0.001238	-0.001672	-0.007733	0.002668	0.001828	-0.009699
2019-12-30	-0.007407	-0.003768	-0.001948	-0.018186	-0.008619	-0.019209
2019-12-31	0.004477	0.007775	0.002928	0.009261	0.000698	0.012827



Symbols	ADBE	CSCO	HPQ	IBM	MSFT	NVDA
count	252.000000	252.000000	252.000000	252.000000	252.000000	252.000000
mean	279.322818	49.205063	19.313817	132.608199	129.186055	174.166609
std	21.752600	4.200723	1.408966	6.428383	15.278252	25.087806
min	215.699997	39.581779	15.744497	106.628937	95.719376	127.415871
25%	266.264992	45.784278	18.431488	130.790974	117.781679	153.833103
50%	277.779999	48.351564	19.268356	132.955559	133.948311	170.877266
75%	293.307510	53.284943	20.242229	136.054127	138.260609	187.855320
max	331.200012	56.656013	22.904491	146.323151	158.527008	239.226898





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Time Period: [Apr 08, 2010 - Apr 08, 2020](#) Show: [Historical Prices](#) Frequency: [Daily](#) [Apply](#)

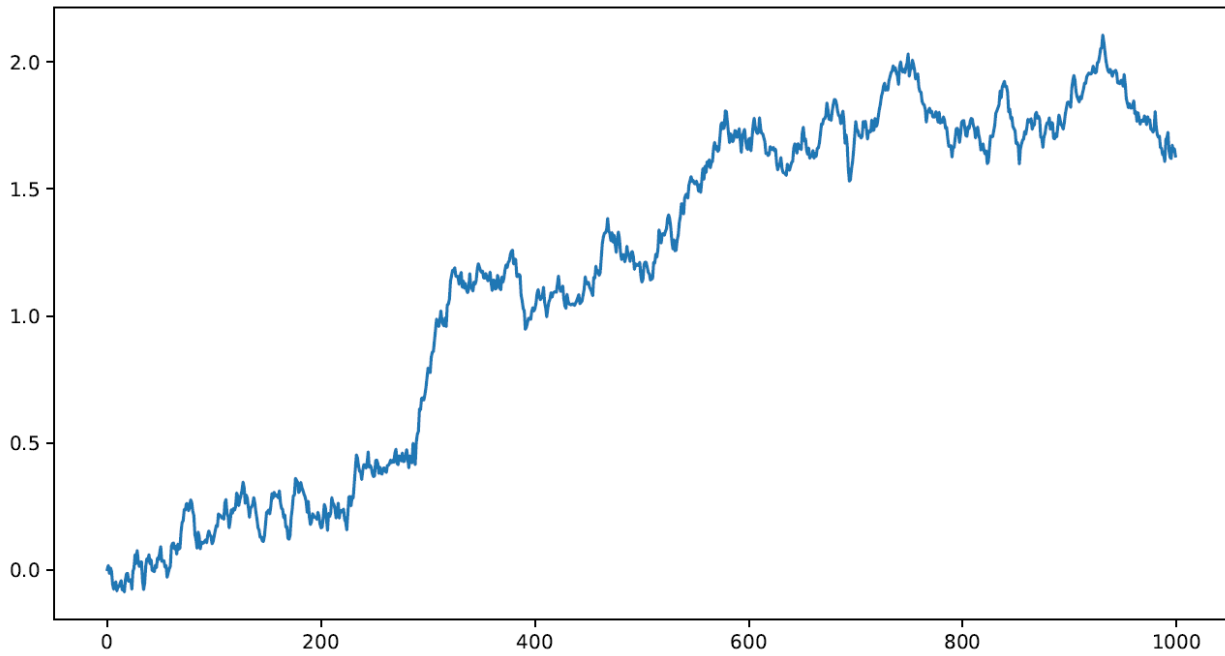
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Currency in USD

Date	Open	High	Low	Close*	Adj Close**	Volume
Apr 07, 2020	2,017.11	2,035.72	1,997.62	2,011.60	2,011.60	5,113,983
Apr 06, 2020	1,936.00	1,998.52	1,930.02	1,997.59	1,997.59	5,761,200
Apr 03, 2020	1,911.15	1,926.33	1,889.15	1,906.59	1,906.59	3,609,900
Apr 02, 2020	1,901.64	1,927.53	1,890.00	1,918.83	1,918.83	4,336,000
Apr 01, 2020	1,932.97	1,944.96	1,893.00	1,907.70	1,907.70	4,121,900
Mar 31, 2020	1,964.35	1,993.02	1,944.01	1,949.72	1,949.72	5,123,600
Mar 30, 2020	1,922.83	1,973.63	1,912.34	1,963.95	1,963.95	6,126,100
Mar 27, 2020	1,930.86	1,939.79	1,899.92	1,900.10	1,900.10	5,387,900

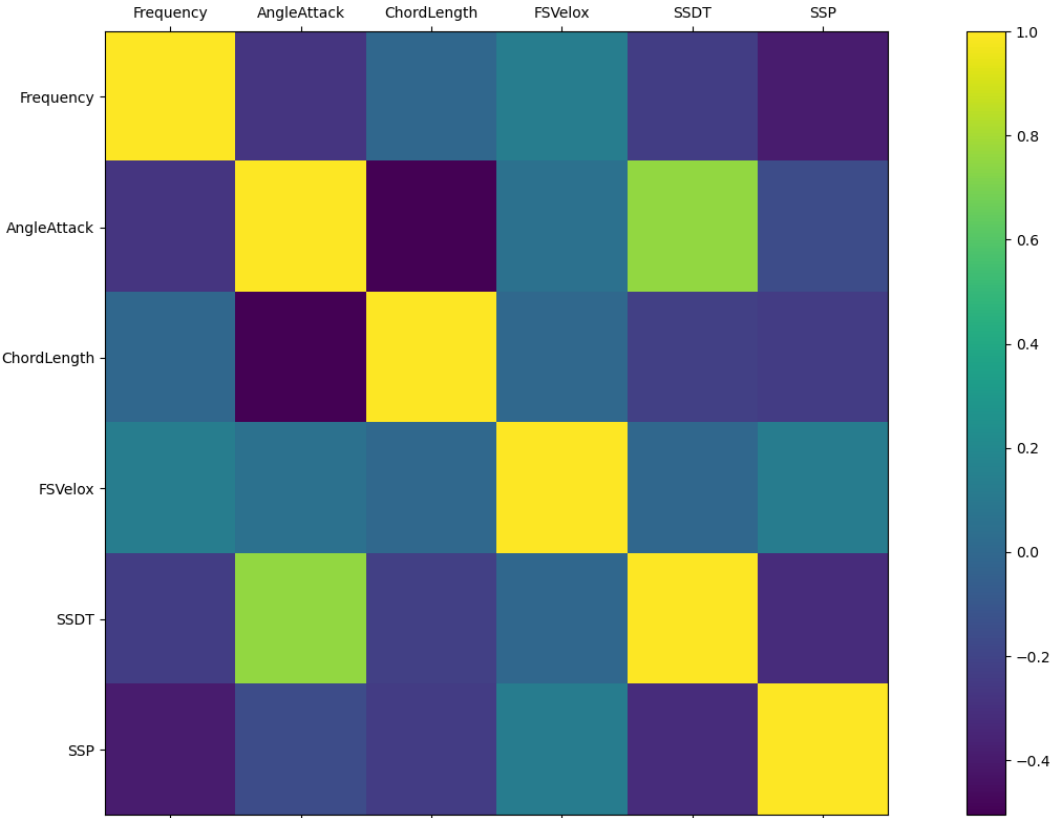
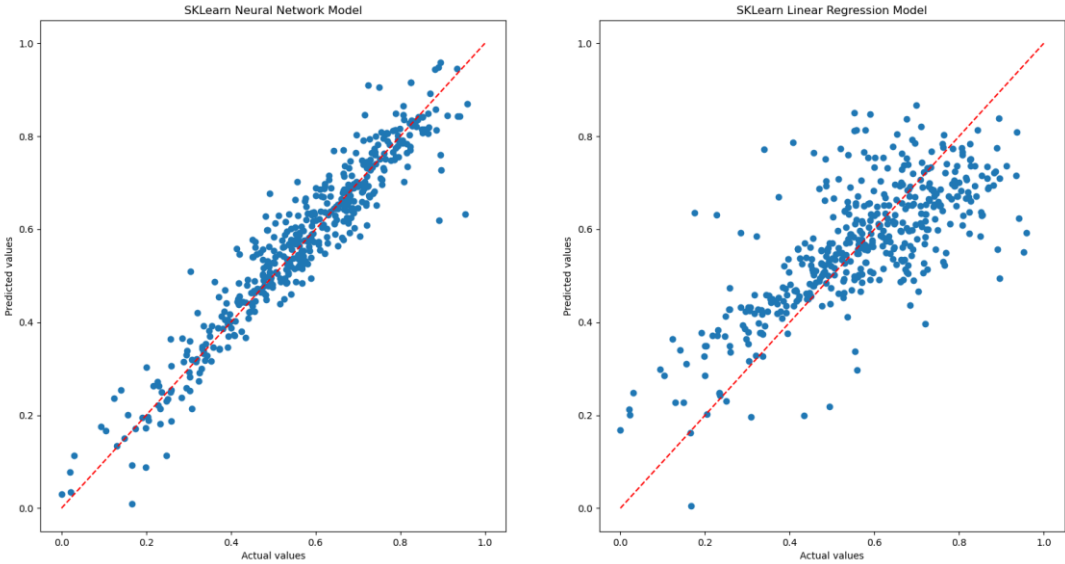
People Also Watch

Symbol	Last Price	Change	% Change
<b>FB</b> Facebook, Inc.	168.83	+3.28	+1.98%
<b>GOOG</b> Alphabet Inc.	1,186.51	-0.41	-0.03%
<b>AAPL</b> Apple Inc.	259.43	-3.04	-1.16%
<b>NFLX</b> Netflix, Inc.	372.28	-7.68	-2.02%
<b>TSLA</b> Tesla, Inc.	545.45	+29.21	+5.66%

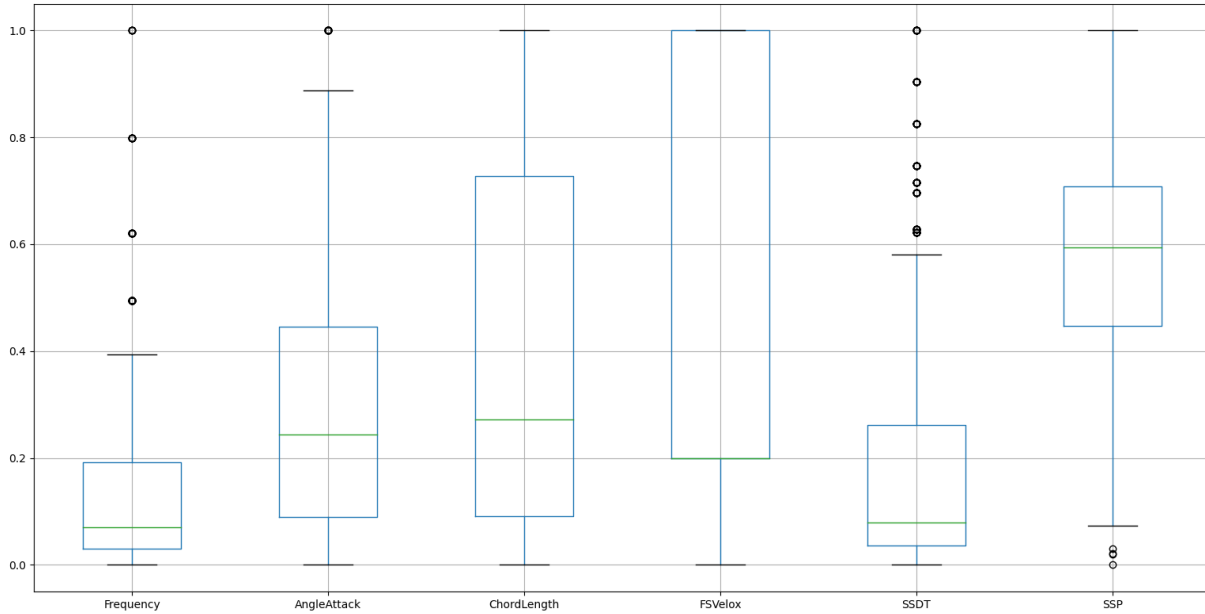




# Chapter 9: Simulating Physical Phenomena Using Neural Networks



	Frequency	AngleAttack	ChordLength	FSVelox	SSDT	SSP
Frequency	1.000000	-0.272765	-0.003661	0.133664	-0.230107	-0.390711
AngleAttack	-0.272765	1.000000	-0.504868	0.058760	0.753394	-0.156108
ChordLength	-0.003661	-0.504868	1.000000	0.003787	-0.220842	-0.236162
FSVelox	0.133664	0.058760	0.003787	1.000000	-0.003974	0.125103
SSDT	-0.230107	0.753394	-0.220842	-0.003974	1.000000	-0.312670
SSP	-0.390711	-0.156108	-0.236162	0.125103	-0.312670	1.000000



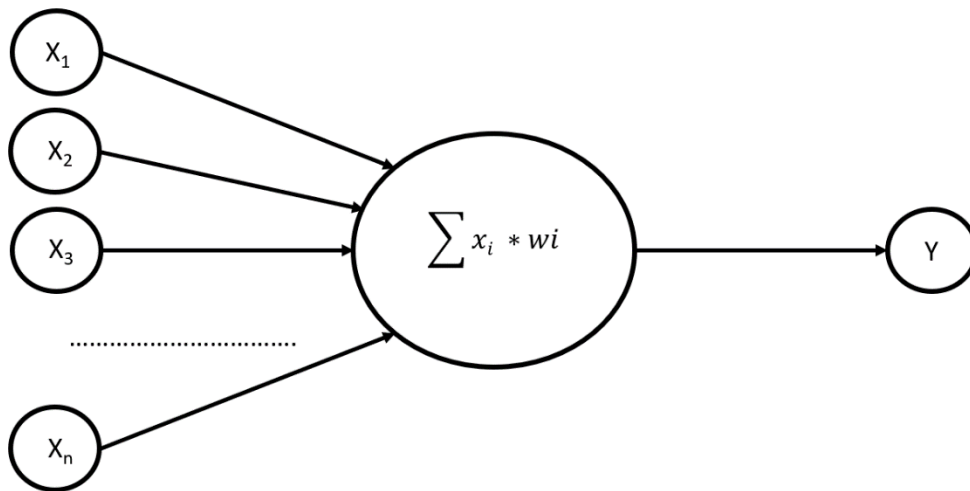
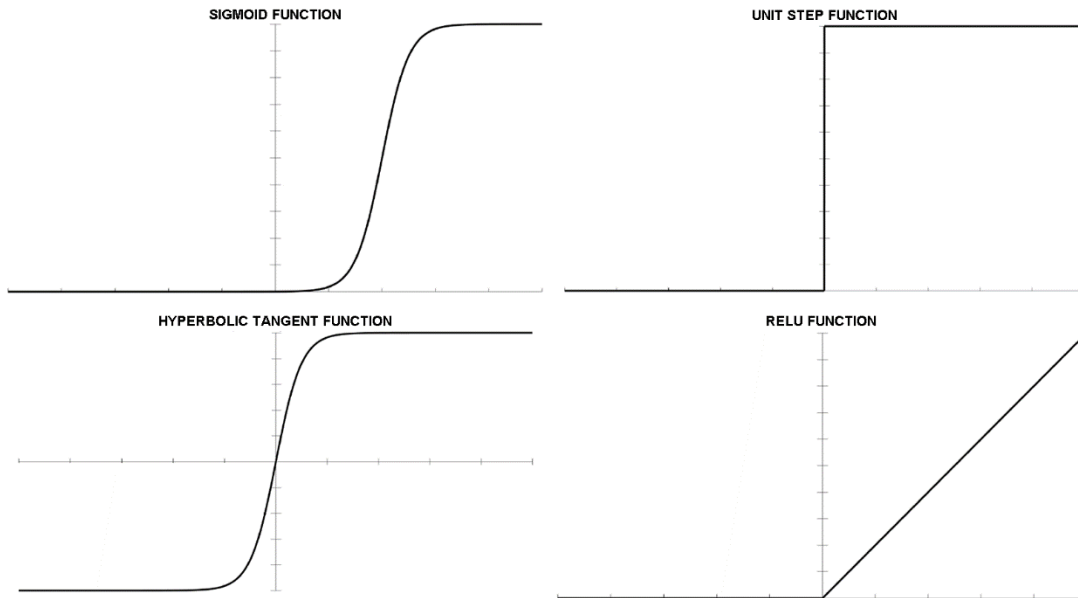
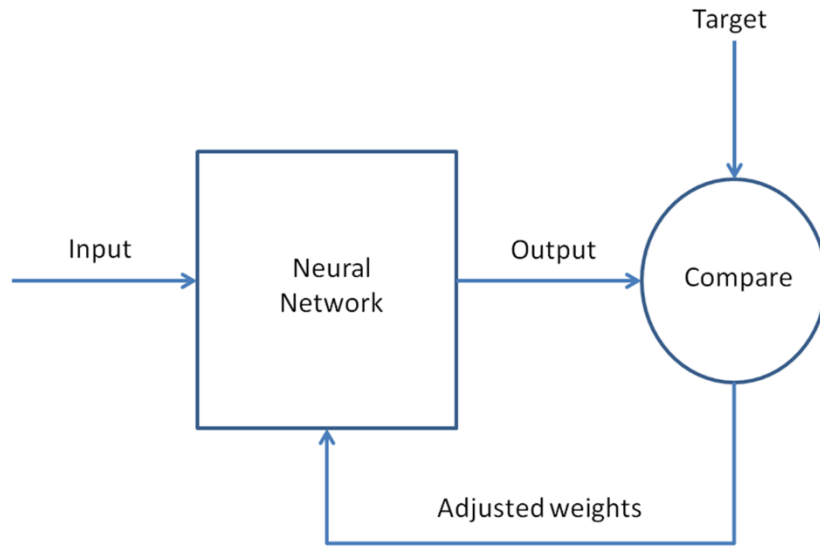
	count	mean	std	min	25%	50%	75%	\
Frequency	1503.0	0.135676	0.159221	0.0	0.030303	0.070707	0.191919	
AngleAttack	1503.0	0.305509	0.266582	0.0	0.090090	0.243243	0.445946	
ChordLength	1503.0	0.397810	0.334791	0.0	0.090909	0.272727	0.727273	
FSVelox	1503.0	0.483857	0.393252	0.0	0.199495	0.199495	1.000000	
SSDT	1503.0	0.185125	0.226687	0.0	0.036794	0.078550	0.261594	
SSP	1503.0	0.570531	0.183441	0.0	0.447018	0.594065	0.707727	

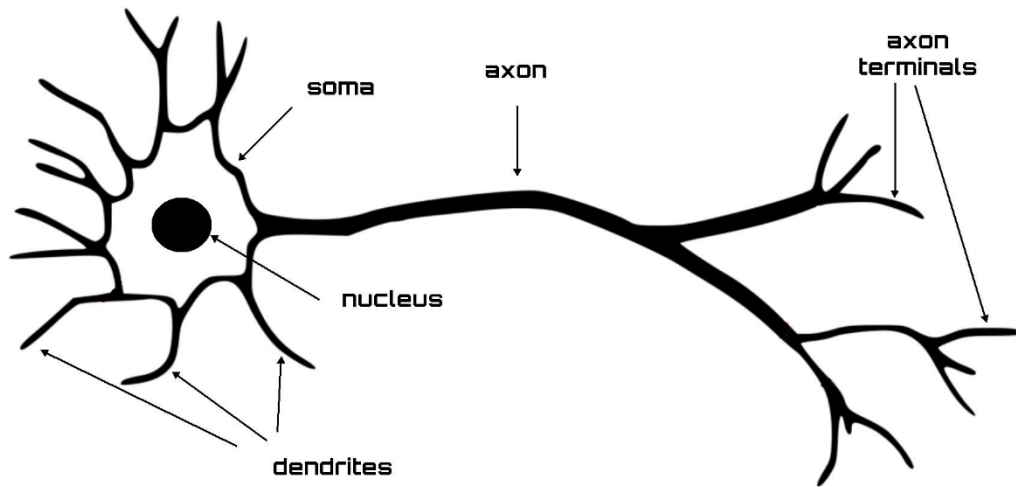
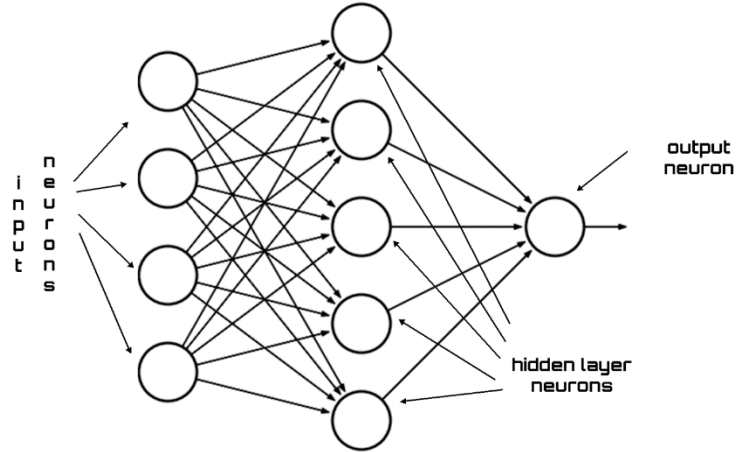
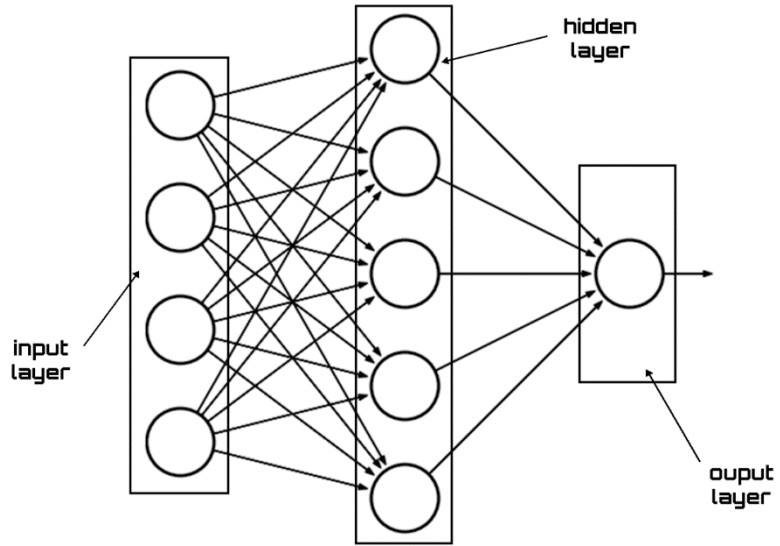
	max
Frequency	1.0
AngleAttack	1.0
ChordLength	1.0
FSVelox	1.0
SSDT	1.0
SSP	1.0

	count	mean	std	min	25%	\
Frequency	1503.0	2886.380572	3152.573137	200.000000	800.000000	
AngleAttack	1503.0	6.782302	5.918128	0.000000	2.000000	
ChordLength	1503.0	0.136548	0.093541	0.025400	0.050800	
FSVelox	1503.0	50.860745	15.572784	31.700000	39.600000	
SSDT	1503.0	0.011140	0.013150	0.000401	0.002535	
SSP	1503.0	124.835943	6.898657	103.380000	120.191000	

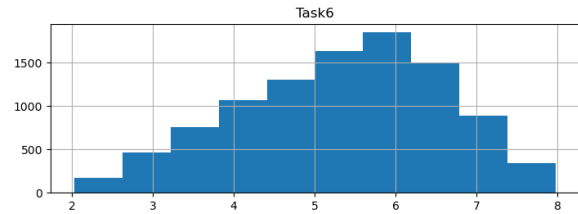
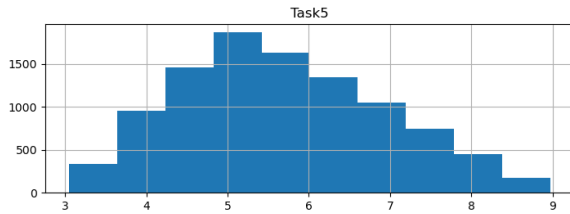
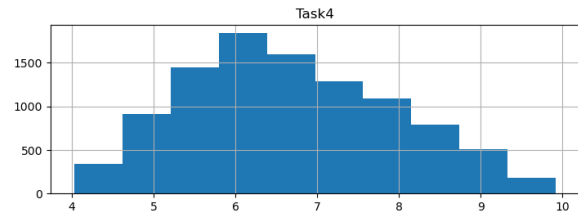
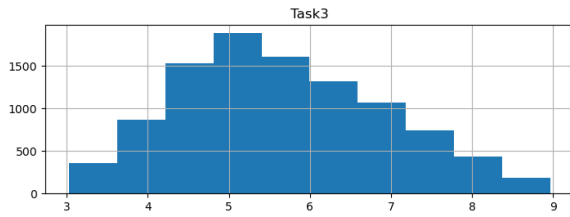
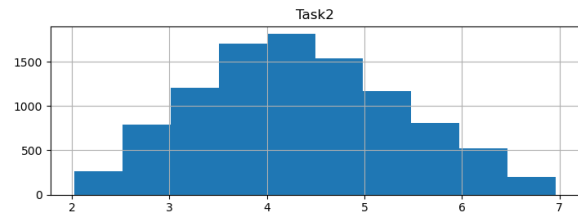
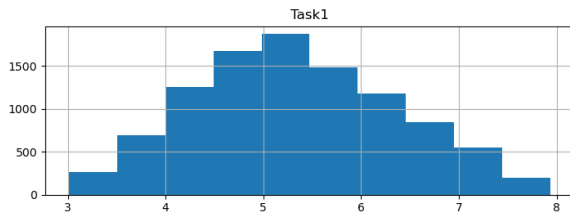
	50%	75%	max
Frequency	1600.000000	4000.000000	20000.000000
AngleAttack	5.400000	9.900000	22.200000
ChordLength	0.101600	0.228600	0.304800
FSVelox	39.600000	71.300000	71.300000
SSDT	0.004957	0.015576	0.058411
SSP	125.721000	129.995500	140.987000

	Frequency	AngleAttack	ChordLength	FSVelox	SSDT	SSP
0	800	0.0	0.3048	71.3	0.002663	126.201
1	1000	0.0	0.3048	71.3	0.002663	125.201
2	1250	0.0	0.3048	71.3	0.002663	125.951
3	1600	0.0	0.3048	71.3	0.002663	127.591
4	2000	0.0	0.3048	71.3	0.002663	127.461
5	2500	0.0	0.3048	71.3	0.002663	125.571
6	3150	0.0	0.3048	71.3	0.002663	125.201
7	4000	0.0	0.3048	71.3	0.002663	123.061
8	5000	0.0	0.3048	71.3	0.002663	121.301
9	6300	0.0	0.3048	71.3	0.002663	119.541
10	8000	0.0	0.3048	71.3	0.002663	117.151
11	10000	0.0	0.3048	71.3	0.002663	115.391
12	12500	0.0	0.3048	71.3	0.002663	112.241
13	16000	0.0	0.3048	71.3	0.002663	108.721
14	500	0.0	0.3048	55.5	0.002831	126.416
15	630	0.0	0.3048	55.5	0.002831	127.696
16	800	0.0	0.3048	55.5	0.002831	128.086
17	1000	0.0	0.3048	55.5	0.002831	126.966
18	1250	0.0	0.3048	55.5	0.002831	126.086
19	1600	0.0	0.3048	55.5	0.002831	126.986
20	2000	0.0	0.3048	55.5	0.002831	126.616



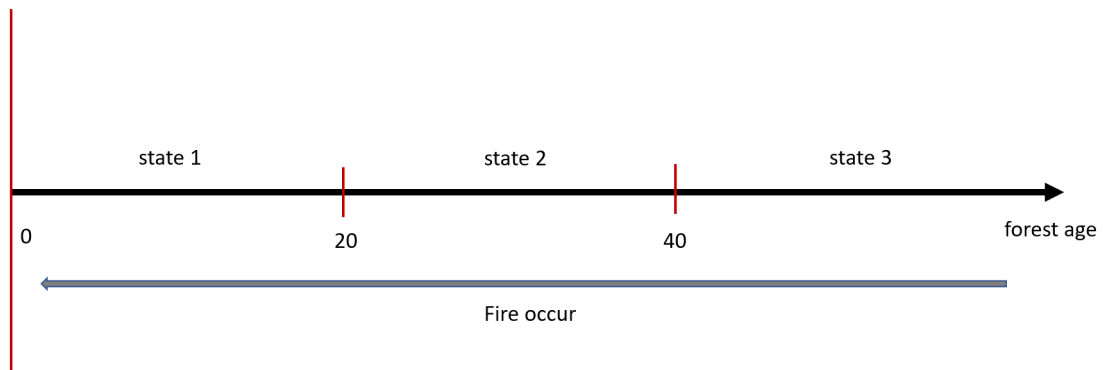
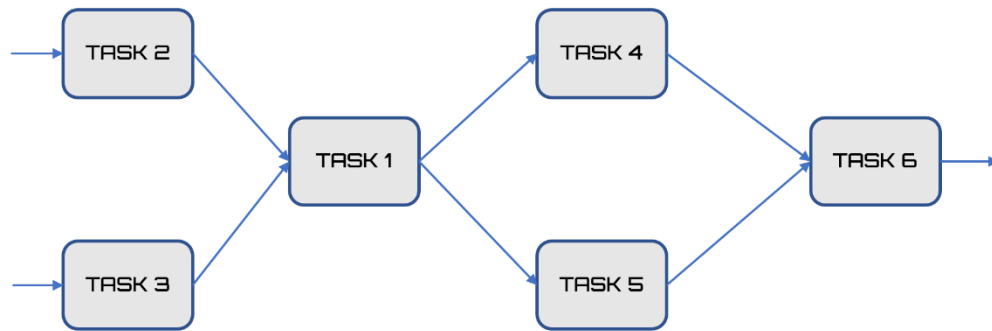
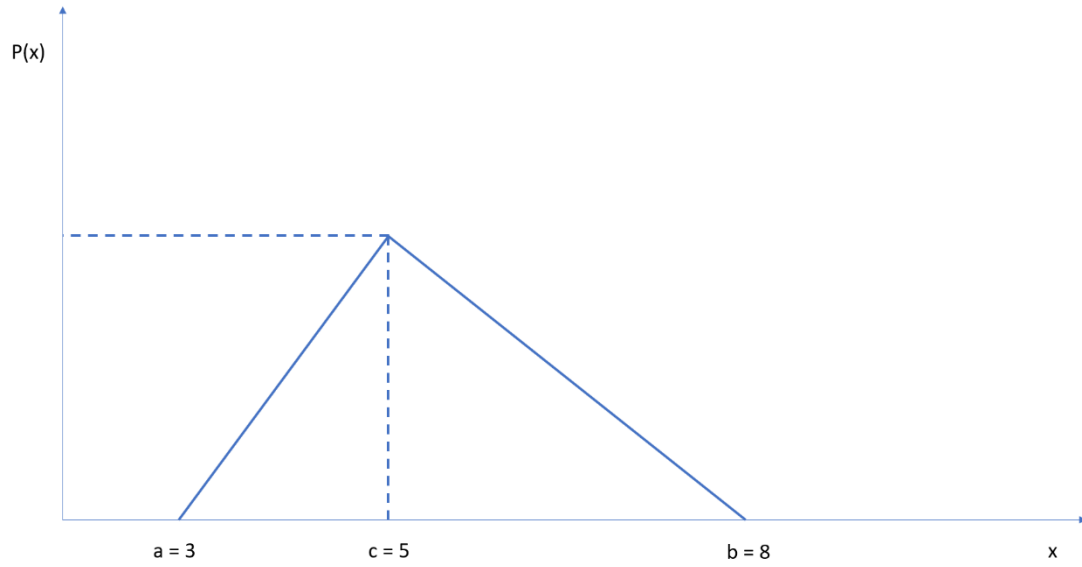


# Chapter 10: Modeling and Simulation for Project Management

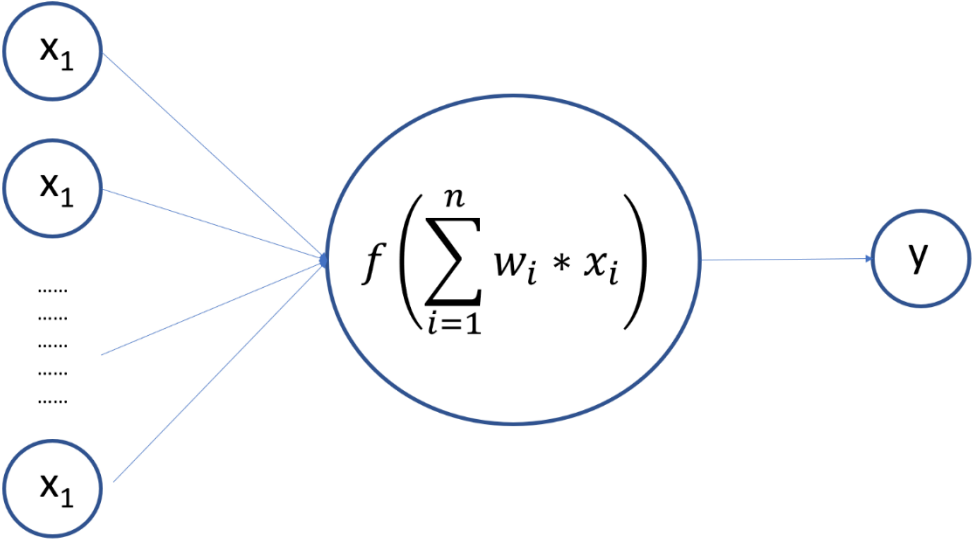
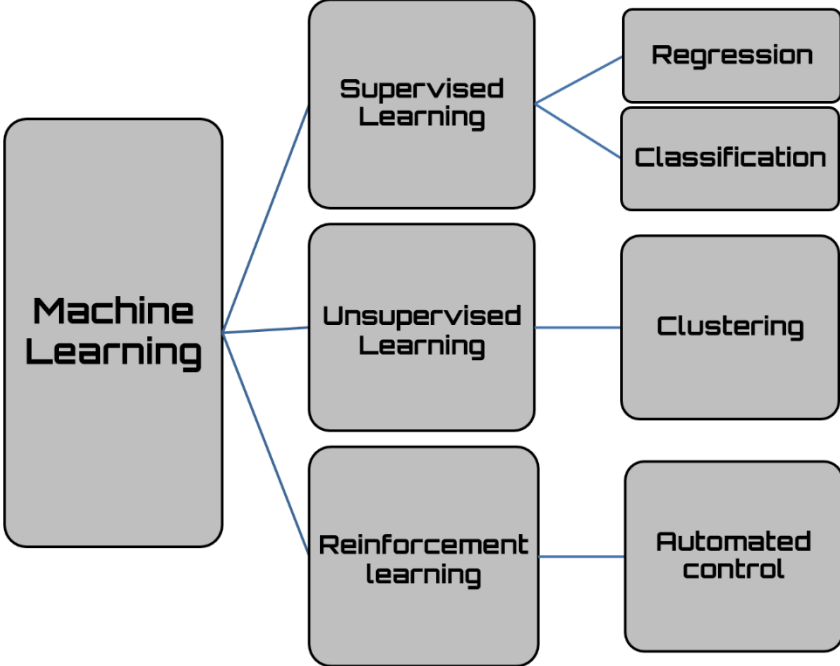


	Task1	Task2	Task3
count	10000.000000	10000.000000	10000.000000
mean	5.334687	4.336086	5.662239
std	1.022804	1.027895	1.250554
min	3.015679	2.027039	3.031016
25%	4.581429	3.589910	4.728432
50%	5.254768	4.274976	5.526395
75%	6.058666	5.058137	6.559695
max	7.931496	6.958586	8.962228

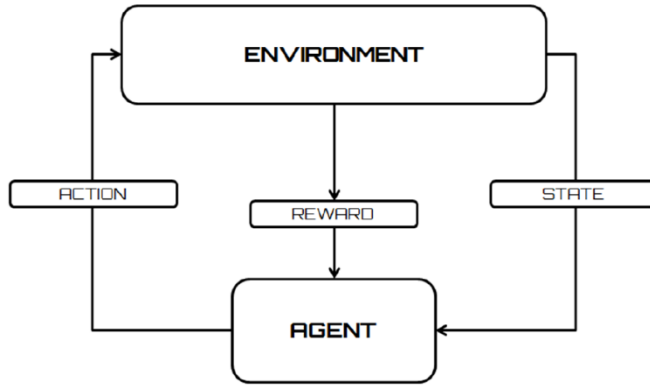
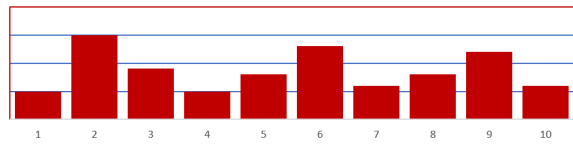
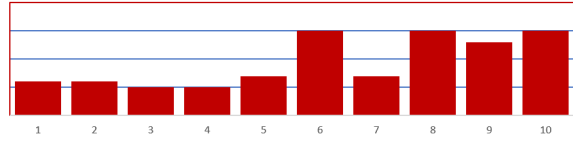
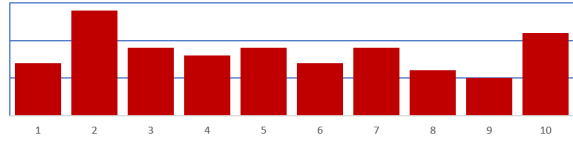
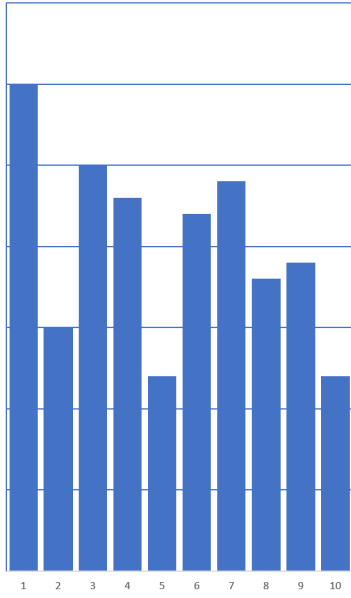
	Task4	Task5	Task6
count	10000.000000	10000.000000	10000.000000
mean	6.676473	5.675249	5.326908
std	1.258054	1.248865	1.254785
min	4.035221	3.053461	2.034225
25%	5.735770	4.744179	4.425259
50%	6.545980	5.553995	5.461404
75%	7.591595	6.556427	6.266919
max	9.912979	8.967686	7.973863



# Chapter 11: What's Next?









$$\rightarrow y = f(x_1, x_2, \dots, x_n) \rightarrow$$

