CSC 790: Graduate Seminar

Project 1

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```
In [1]:  import numpy as np
         import pandas as pd
         from IPython.display import display, HTML
```

```
In [2]:  POPULATION_SIZE = 2000
         INITIAL_INFECTIONS = 5
         RECOVERY_TIME = 12
         LAST_INFECTED_DAYS_COUNT = 0
         current_infections_count = 5
         recovered_count = 0
         death_count = 0
         classical_mortality_rate = 0
         progressive_mortality_rate = 0
         classical_recovery_rate = 0
         progressive_recovery_rate = 0
         day_count = 1
         result_rows = [[day_count, current_infections_count, recovered_count, death_count, cla
```

```
In [3]:  while current_infections_count <= POPULATION_SIZE:

             day_count += 1

             # Generate number of new infections
             current_infections_count += np.random.randint(50)
             if current_infections_count > POPULATION_SIZE:
                 current_infections_count = POPULATION_SIZE

             # Generate number of recovered cases
             if day_count > 9:
                 if LAST_INFECTED_DAYS_COUNT < 10:
                     recovered_count += np.random.randint(45)

             # Generate number of death cases
             if day_count > 8:
                 if LAST_INFECTED_DAYS_COUNT < 10:
                     death_count += np.random.randint(5)

             # Calculate classical mortality rate
             classical_mortality_rate = (death_count / current_infections_count) * 100

             # Calculate progressive mortality rate
             if day_count >= RECOVERY_TIME:
                 progressive_mortality_rate = (death_count / result_rows[(day_count - RECOVERY_
```

```python
        # Calculate classical recovery rate
        classical_recovery_rate = (recovered_count / current_infections_count) * 100

        # Calculate progressive recovery rate
        if day_count >= RECOVERY_TIME:
            progressive_recovery_rate = (recovered_count / result_rows[(day_count - RECOVE

        result_rows.append([day_count, current_infections_count, recovered_count, death_co

        if current_infections_count == POPULATION_SIZE:
            LAST_INFECTED_DAYS_COUNT += 1
            if LAST_INFECTED_DAYS_COUNT > RECOVERY_TIME:
                break
```

In [4]:
```python
df = pd.DataFrame(result_rows,
                  columns=['Day',
                           'Infections',
                           'Recoveries',
                           'Deaths',
                           'Classical Mortality Rate (%)',
                           'Progressive Mortality Rate (%)',
                           'Classical Recovery Rate (%)',
                           'Progressive Recovery Rate (%)'])

df['Recoveries'].replace(0, '', inplace=True)
df['Deaths'].replace(0, '', inplace=True)
df['Classical Mortality Rate (%)'].replace(0, '', inplace=True)
df['Progressive Mortality Rate (%)'].replace(0, '', inplace=True)
df['Classical Recovery Rate (%)'].replace(0, '', inplace=True)
df['Progressive Recovery Rate (%)'].replace(0, '', inplace=True)

pd.options.display.max_rows = 200
pd.set_option('display.precision', 2)
display(HTML(df.to_html(index=False)))
```

Day	Infections	Recoveries	Deaths	Classical Mortality Rate (%)	Progressive Mortality Rate (%)	Classical Recovery Rate (%)	Progressive Recovery Rate (%)
1	5						
2	10						
3	10						
4	10						
5	38						
6	49						
7	51						
8	93						
9	112		1	0.89			
10	160	43	2	1.25		26.88	
11	207	76	5	2.42		36.71	
12	228	118	5	2.19	100.0	51.75	2360.0
13	258	127	7	2.71	70.0	49.22	1270.0
14	303	161	9	2.97	90.0	53.14	1610.0
15	317	201	13	4.1	130.0	63.41	2010.0
16	336	212	13	3.87	34.21	63.1	557.89
17	343	256	15	4.37	30.61	74.64	522.45
18	356	259	15	4.21	29.41	72.75	507.84
19	381	303	19	4.99	20.43	79.53	325.81
20	400	324	23	5.75	20.54	81.0	289.29
21	434	365	27	6.22	16.88	84.1	228.12
22	472	394	29	6.14	14.01	83.47	190.34
23	511	407	32	6.26	14.04	79.65	178.51
24	550	430	34	6.18	13.18	78.18	166.67
25	570	440	38	6.67	12.54	77.19	145.21
26	578	462	42	7.27	13.25	79.93	145.74
27	622	494	42	6.75	12.5	79.42	147.02
28	643	523	42	6.53	12.24	81.34	152.48
29	684	529	42	6.14	11.8	77.34	148.6
30	730	538	43	5.89	11.29	73.7	141.21
31	730	579	46	6.3	11.5	79.32	144.75
32	753	586	46	6.11	10.6	77.82	135.02

Day	Infections	Recoveries	Deaths	Classical Mortality Rate (%)	Progressive Mortality Rate (%)	Classical Recovery Rate (%)	Progressive Recovery Rate (%)
33	754	598	46	6.1	9.75	79.31	126.69
34	797	615	49	6.15	9.59	77.16	120.35
35	844	616	51	6.04	9.27	72.99	112.0
36	847	659	55	6.49	9.65	77.8	115.61
37	871	676	57	6.54	9.86	77.61	116.96
38	883	713	59	6.68	9.49	80.75	114.63
39	903	731	63	6.98	9.8	80.95	113.69
40	929	741	66	7.1	9.65	79.76	108.33
41	951	782	66	6.94	9.04	82.23	107.12
42	979	782	70	7.15	9.59	79.88	107.12
43	990	803	72	7.27	9.56	81.11	106.64
44	1031	822	74	7.18	9.81	79.73	109.02
45	1043	823	75	7.19	9.41	78.91	103.26
46	1072	840	76	7.09	9.0	78.36	99.53
47	1104	841	77	6.97	9.09	76.18	99.29
48	1111	843	78	7.02	8.96	75.88	96.79
49	1148	884	80	6.97	9.06	77.0	100.11
50	1158	896	82	7.08	9.08	77.37	99.22
51	1198	896	82	6.84	8.83	74.79	96.45
52	1208	915	84	6.95	8.83	75.75	96.21
53	1239	921	86	6.94	8.78	74.33	94.08
54	1260	954	89	7.06	8.99	75.71	96.36
55	1273	965	89	6.99	8.63	75.81	93.6
56	1315	981	91	6.92	8.72	74.6	94.06
57	1346	1000	92	6.84	8.58	74.29	93.28
58	1361	1006	92	6.76	8.33	73.92	91.12
59	1372	1016	92	6.71	8.28	74.05	91.45
60	1386	1036	94	6.78	8.19	74.75	90.24
61	1393	1041	95	6.82	8.2	74.73	89.9
62	1403	1073	99	7.06	8.26	76.48	89.57
63	1426	1098	100	7.01	8.28	77.0	90.89
64	1430	1122	101	7.06	8.15	78.46	90.56

Day	Infections	Recoveries	Deaths	Classical Mortality Rate (%)	Progressive Mortality Rate (%)	Classical Recovery Rate (%)	Progressive Recovery Rate (%)
65	1444	1123	101	6.99	8.02	77.77	89.13
66	1455	1155	104	7.15	8.17	79.38	90.73
67	1461	1176	106	7.26	8.06	80.49	89.43
68	1474	1194	110	7.46	8.17	81.0	88.71
69	1492	1226	113	7.57	8.3	82.17	90.08
70	1523	1244	117	7.68	8.53	81.68	90.67
71	1533	1246	119	7.76	8.59	81.28	89.9
72	1542	1288	119	7.72	8.54	83.53	92.46
73	1567	1326	120	7.66	8.55	84.62	94.51
74	1568	1354	123	7.84	8.63	86.35	94.95
75	1592	1363	125	7.85	8.74	85.62	95.31
76	1641	1380	125	7.62	8.66	84.1	95.57
77	1683	1417	125	7.43	8.59	84.19	97.39
78	1717	1422	128	7.45	8.76	82.82	97.33
79	1760	1431	131	7.44	8.89	81.31	97.08
80	1770	1449	133	7.51	8.91	81.86	97.12
81	1800	1473	137	7.61	9.0	81.83	96.72
82	1844	1516	137	7.43	8.94	82.21	98.89
83	1889	1546	137	7.25	8.88	81.84	100.26
84	1907	1553	139	7.29	8.87	81.44	99.11
85	1922	1562	143	7.44	9.12	81.27	99.62
86	1942	1579	144	7.42	9.05	81.31	99.18
87	1979	1607	144	7.28	8.78	81.2	97.93
88	2000	1609	146	7.3	8.67	80.45	95.6
89	2000	1630	150	7.5	8.74	81.5	94.93
90	2000	1648	154	7.7	8.75	82.4	93.64
91	2000	1660	154	7.7	8.7	83.0	93.79
92	2000	1665	155	7.75	8.61	83.25	92.5
93	2000	1702	155	7.75	8.41	85.1	92.3
94	2000	1719	158	7.9	8.36	85.95	91.0
95	2000	1734	162	8.1	8.5	86.7	90.93
96	2000	1736	166	8.3	8.64	86.8	90.32

Day	Infections	Recoveries	Deaths	Classical Mortality Rate (%)	Progressive Mortality Rate (%)	Classical Recovery Rate (%)	Progressive Recovery Rate (%)
97	2000	1764	170	8.5	8.75	88.2	90.83
98	2000	1782	174	8.5	8.59	88.2	89.14
99	2000	1798	180	8.5	8.5	88.2	88.2
100	2000	1816	184	8.5	8.5	88.2	88.2

In [ ]:

Day	Infections	Recoveries	Deaths	Classical Mortality Rate (%)	Progressive Mortality Rate (%)	Classical Recovery Rate (%)	Progressive Recovery Rate (%)