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Class: CS575

Professor: Mike Bailey

Project 3

1. What your own-choice quantity was and how it fits into the simulation.

I chose to use the two variables of Wolf and grain height to control the deer population. Once the deer population is more than twice the height of the grain, they are easily spotted and killed by wolves. So, by this algorithm, the number of overabundant deer decreases every month until the number of deer is less than twice the height of the grain. This allows deer populations to remain within a stable range (about 0-13), rather than growing indefinitely. In addition, the number of wolves is affected by the number of deer. When the number of wolves is less than or equal to the number of deer, the number of wolves will increase because there is plenty of food. When wolves outnumber deer, the Wolf population decreases because there is not enough food to go around. This data makes the simulation more realistic.

2. A table showing values for temperature, precipitation, number of deer, height of the grain, and your own-choice quantity as a function of month number.

```
2021 Year:     1 Month      3 Deers     GrainHeight: 12.14     Precip: 24.77     Temp: -0.73     Wolves: 3
2021 Year:     2 Month      6 Deers     GrainHeight:  9.25     Precip: 24.56     Temp: 11.42     Wolves: 4
2021 Year:     3 Month      7 Deers     GrainHeight:  0.00     Precip: 33.87     Temp: 15.61     Wolves: 7
2021 Year:     4 Month      8 Deers     GrainHeight:  0.00     Precip: 37.58     Temp: 17.63     Wolves: 8
2021 Year:     5 Month      6 Deers     GrainHeight:  0.00     Precip: 26.87     Temp: 25.32     Wolves: 9
2021 Year:     6 Month      5 Deers     GrainHeight:  0.00     Precip: 22.32     Temp: 23.52     Wolves: 7
2021 Year:     7 Month      4 Deers     GrainHeight:  0.00     Precip: 12.16     Temp: 23.44     Wolves: 6
2021 Year:     8 Month      3 Deers     GrainHeight:  0.00     Precip:  4.75     Temp: 23.90     Wolves: 5
2021 Year:     9 Month      2 Deers     GrainHeight:  0.00     Precip:  1.53     Temp: 21.60     Wolves: 4
2021 Year:    10 Month      1 Deers     GrainHeight:  0.12     Precip:  7.78     Temp: 10.00     Wolves: 3
2021 Year:    11 Month      0 Deers     GrainHeight:  0.00     Precip:  3.46     Temp: 11.69     Wolves: 2
2021 Year:    12 Month      0 Deers     GrainHeight: 10.13     Precip: 11.34     Temp:  8.40     Wolves: 0
2022 Year:     1 Month      3 Deers     GrainHeight: 18.64     Precip: 26.28     Temp:  9.96     Wolves: 0
2022 Year:     2 Month      6 Deers     GrainHeight: 29.77     Precip: 33.42     Temp:  6.19     Wolves: 4
2022 Year:     3 Month      9 Deers     GrainHeight: 14.61     Precip: 36.16     Temp: 17.45     Wolves: 7
2022 Year:     4 Month     10 Deers     GrainHeight:  0.00     Precip: 36.19     Temp: 23.01     Wolves: 10
2022 Year:     5 Month     11 Deers     GrainHeight:  0.00     Precip: 33.36     Temp: 23.92     Wolves: 11
2022 Year:     6 Month      9 Deers     GrainHeight:  0.00     Precip: 17.44     Temp: 21.39     Wolves: 12
2022 Year:     7 Month      8 Deers     GrainHeight:  0.00     Precip: 13.93     Temp: 30.66     Wolves: 10
2022 Year:     8 Month      7 Deers     GrainHeight:  0.00     Precip:  3.30     Temp: 24.51     Wolves: 9
2022 Year:     9 Month      6 Deers     GrainHeight:  0.00     Precip:  3.76     Temp: 22.91     Wolves: 8
2022 Year:    10 Month      5 Deers     GrainHeight:  0.00     Precip:  4.27     Temp: 14.12     Wolves: 7
2022 Year:    11 Month      4 Deers     GrainHeight:  0.00     Precip: 11.91     Temp:  9.14     Wolves: 6
2022 Year:    12 Month      3 Deers     GrainHeight:  5.21     Precip: 11.48     Temp:  6.17     Wolves: 5
2023 Year:     1 Month      2 Deers     GrainHeight: 14.17     Precip: 24.24     Temp:  7.58     Wolves: 4
2023 Year:     2 Month      5 Deers     GrainHeight: 11.20     Precip: 32.62     Temp: 12.88     Wolves: 3
2023 Year:     3 Month      6 Deers     GrainHeight:  0.00     Precip: 33.12     Temp: 15.61     Wolves: 6
2023 Year:     4 Month      7 Deers     GrainHeight:  0.00     Precip: 34.32     Temp: 18.21     Wolves: 7
2023 Year:     5 Month      5 Deers     GrainHeight:  0.00     Precip: 33.10     Temp: 22.81     Wolves: 8
2023 Year:     6 Month      4 Deers     GrainHeight:  0.00     Precip: 18.94     Temp: 25.00     Wolves: 6
2023 Year:     7 Month      3 Deers     GrainHeight:  0.00     Precip: 13.64     Temp: 31.61     Wolves: 5
2023 Year:     8 Month      2 Deers     GrainHeight:  0.00     Precip:  2.69     Temp: 20.66     Wolves: 4
2023 Year:     9 Month      1 Deers     GrainHeight:  0.00     Precip:  4.03     Temp: 16.54     Wolves: 3
2023 Year:    10 Month      0 Deers     GrainHeight:  0.00     Precip:  7.84     Temp: 11.87     Wolves: 2
2023 Year:    11 Month      0 Deers     GrainHeight: 12.68     Precip:  7.01     Temp:  5.86     Wolves: 0
2023 Year:    12 Month      3 Deers     GrainHeight: 31.06     Precip: 13.97     Temp:  3.75     Wolves: 0
2024 Year:     1 Month      6 Deers     GrainHeight: 33.35     Precip: 23.51     Temp: -0.62     Wolves: 4
```

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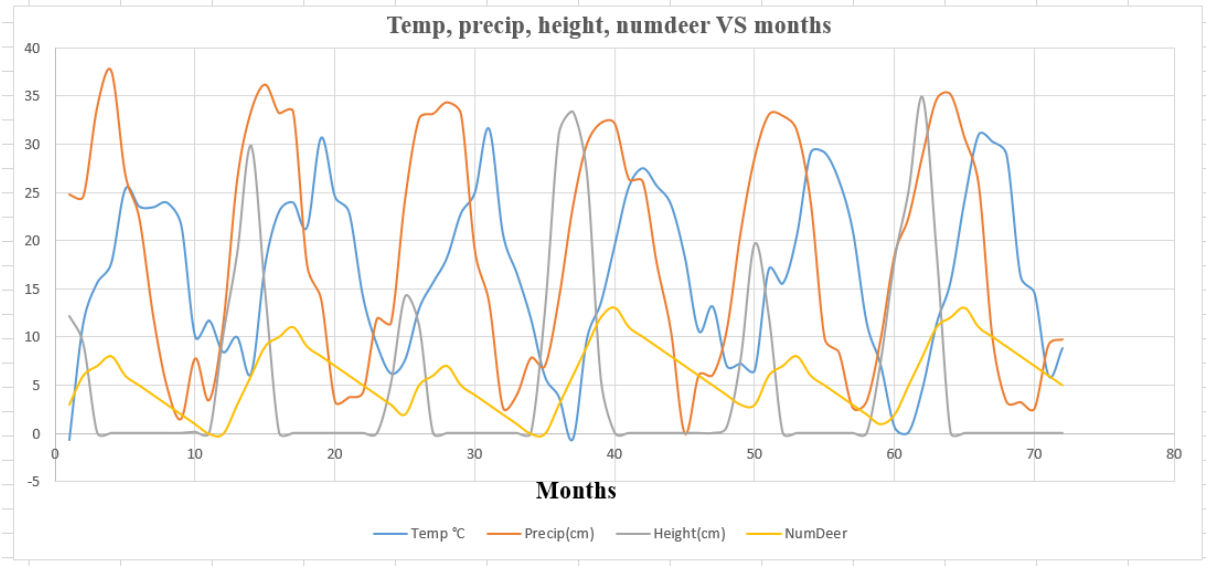
2024 Year:     2 Month      9 Deers     GrainHeight: 26.96     Precip: 29.98     Temp:  9.76     Wolves: 7
2024 Year:     3 Month     12 Deers     GrainHeight:  5.58     Precip: 32.18     Temp: 13.52     Wolves: 10
2024 Year:     4 Month     13 Deers     GrainHeight:  0.00     Precip: 32.10     Temp: 19.58     Wolves: 13
2024 Year:     5 Month     11 Deers     GrainHeight:  0.00     Precip: 26.36     Temp: 25.57     Wolves: 14
2024 Year:     6 Month     10 Deers     GrainHeight:  0.00     Precip: 26.09     Temp: 27.49     Wolves: 12
2024 Year:     7 Month      9 Deers     GrainHeight:  0.00     Precip: 17.60     Temp: 25.64     Wolves: 11
2024 Year:     8 Month      8 Deers     GrainHeight:  0.00     Precip: 10.68     Temp: 23.76     Wolves: 10
2024 Year:     9 Month      7 Deers     GrainHeight:  0.00     Precip:  0.00     Temp: 18.29     Wolves: 9
2024 Year:    10 Month      6 Deers     GrainHeight:  0.00     Precip:  6.05     Temp: 10.58     Wolves: 8
2024 Year:    11 Month      5 Deers     GrainHeight:  0.00     Precip:  6.07     Temp: 13.12     Wolves: 7
2024 Year:    12 Month      4 Deers     GrainHeight:  0.62     Precip: 10.74     Temp:  6.97     Wolves: 6
2025 Year:     1 Month      3 Deers     GrainHeight:  7.74     Precip: 20.93     Temp:  7.22     Wolves: 5
2025 Year:     2 Month      3 Deers     GrainHeight: 19.65     Precip: 28.63     Temp:  6.53     Wolves: 4
2025 Year:     3 Month      6 Deers     GrainHeight: 12.16     Precip: 33.03     Temp: 16.99     Wolves: 4
2025 Year:     4 Month      7 Deers     GrainHeight:  0.00     Precip: 32.92     Temp: 15.52     Wolves: 7
2025 Year:     5 Month      8 Deers     GrainHeight:  0.00     Precip: 31.43     Temp: 20.44     Wolves: 8
2025 Year:     6 Month      6 Deers     GrainHeight:  0.00     Precip: 23.95     Temp: 29.11     Wolves: 9
2025 Year:     7 Month      5 Deers     GrainHeight:  0.00     Precip:  9.83     Temp: 29.11     Wolves: 7
2025 Year:     8 Month      4 Deers     GrainHeight:  0.00     Precip:  8.46     Temp: 26.29     Wolves: 6
2025 Year:     9 Month      3 Deers     GrainHeight:  0.00     Precip:  2.67     Temp: 21.05     Wolves: 5
2025 Year:    10 Month      2 Deers     GrainHeight:  0.00     Precip:  3.34     Temp: 11.47     Wolves: 4
2025 Year:    11 Month      1 Deers     GrainHeight:  7.39     Precip:  9.77     Temp:  7.09     Wolves: 3
2025 Year:    12 Month      2 Deers     GrainHeight: 18.02     Precip: 18.55     Temp:  0.60     Wolves: 2
2026 Year:     1 Month      5 Deers     GrainHeight: 25.13     Precip: 22.42     Temp:  0.09     Wolves: 3
2026 Year:     2 Month      8 Deers     GrainHeight: 34.82     Precip: 28.90     Temp:  4.68     Wolves: 6
2026 Year:     3 Month     11 Deers     GrainHeight: 18.76     Precip: 34.64     Temp: 11.36     Wolves: 9
2026 Year:     4 Month     12 Deers     GrainHeight:  0.00     Precip: 35.14     Temp: 15.72     Wolves: 12
2026 Year:     5 Month     13 Deers     GrainHeight:  0.00     Precip: 30.62     Temp: 24.14     Wolves: 13
2026 Year:     6 Month     11 Deers     GrainHeight:  0.00     Precip: 25.88     Temp: 30.95     Wolves: 14
2026 Year:     7 Month     10 Deers     GrainHeight:  0.00     Precip:  9.80     Temp: 30.23     Wolves: 12
2026 Year:     8 Month      9 Deers     GrainHeight:  0.00     Precip:  3.27     Temp: 28.90     Wolves: 11
2026 Year:     9 Month      8 Deers     GrainHeight:  0.00     Precip:  3.26     Temp: 16.29     Wolves: 10
2026 Year:    10 Month      7 Deers     GrainHeight:  0.00     Precip:  2.60     Temp: 14.52     Wolves: 9
2026 Year:    11 Month      6 Deers     GrainHeight:  0.00     Precip:  9.18     Temp:  5.96     Wolves: 8
2026 Year:    12 Month      5 Deers     GrainHeight:  0.00     Precip:  9.75     Temp:  8.81     Wolves: 7
flip3 ~/CS575 90$
```

3. A graph showing temperature, precipitation, number of deer, height of the grain, and your own-choice quantity as a function of month number.



4. A commentary about the patterns in the graph and why they turned out that way. What evidence in the curves proves that your own quantity is actually affecting the simulation correctly?

As can be seen from the table,

Precipitation changes normally because the code is correct and is not affected by other variables.

The deer population is affected by the height of the grain. A herd that is more than twice the height of the grain is easily found and killed by wolves. As the grain height drops, so does the deer population.

As the precipitation falls, so does the temperature. And vice versa, there is a positive correlation.

The height of grain is affected by precipitation and deer, but the influence of precipitation is difficult to detect due to the large number of deer. When the number of deer is too large, the

grain will be eaten up as soon as it grows, resulting in the lack of height.

In conclusion, when the temperature, precipitation and grain height are the highest, the deer population also presents the peak, showing an obvious positive correlation. It also shows my own quantity is actually affecting the simulation correctly.

These numbers all interact with each other and make the simulation interesting and realistic.