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CS 475

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### Project 3 Write Up

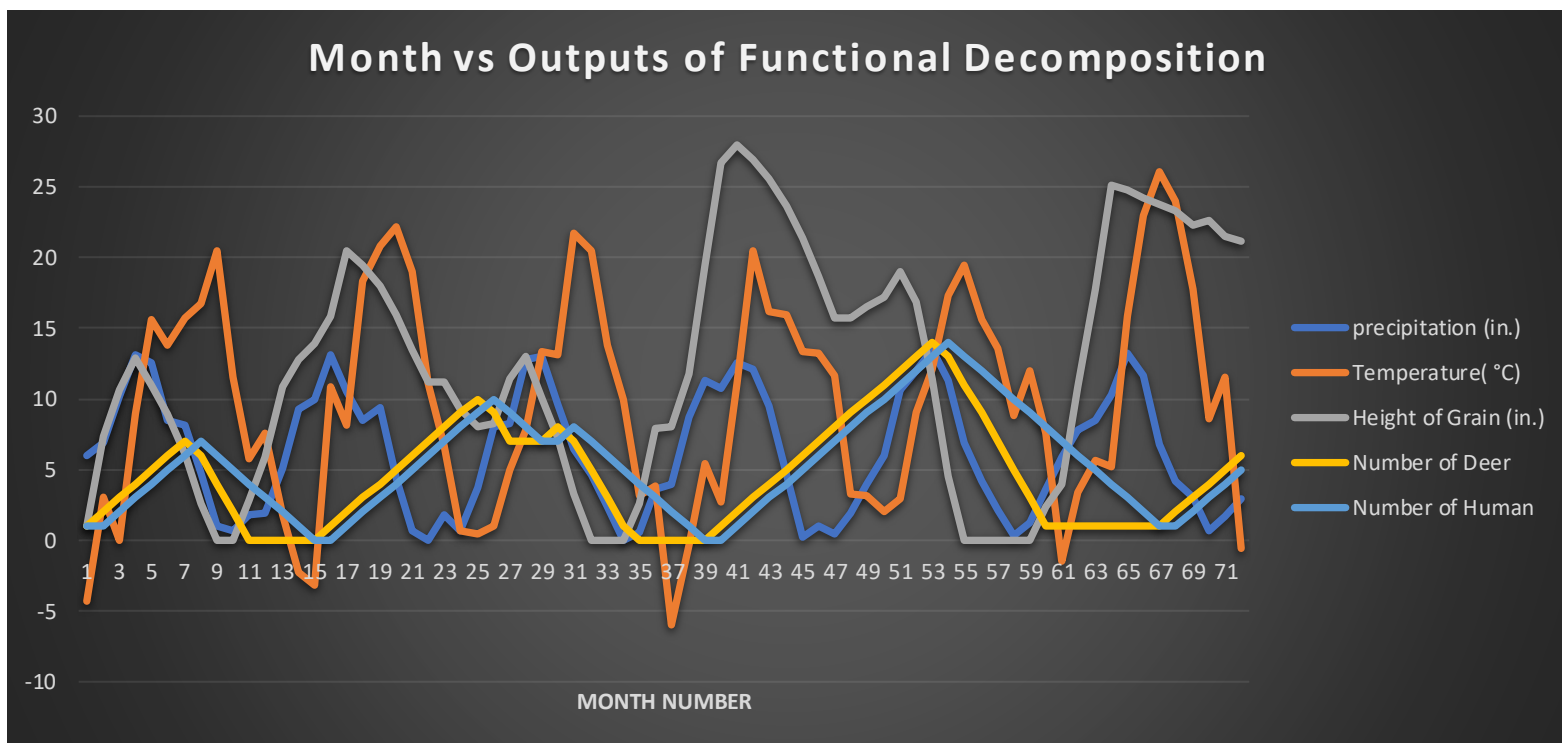
1. What your own-choice quantity was and how it fits into the simulation.
  - a. The entity I added to the simulation was a human agent. The human agent directly interacts with the number of deer, and indirectly interacts with the growing of the grain. The human agent grew if there were more deer than humans, and the population decreased when the opposite was true. Therefore, the growth of the human population was directly dependent on the growth of the deer population. The deer population on the other hand only depletes when the number of humans is greater than the number of deer. However, when the human population becomes too big, it'll decrease the deer population to nothing, allowing grain to build its height.
  - b. One change that I considered to add, was that if the deer population was 0 then the humans could eat directly from the grains. This would allow the human population to always be able to grow whenever the grains and deer are not 0.
2. A table showing values for temperature, precipitation, number of grain deer, height of the grain, and your own-choice quantity as a function of month number.

| Month # | precipitation<br>(in.) | Temperature(°C) | Height of Grain<br>(in.) | Number of Deer | Number of<br>Human |
|---------|------------------------|-----------------|--------------------------|----------------|--------------------|
| 0       | 5.95951                | -4.33739        | 1.05849                  | 1              | 1                  |
| 1       | 6.90566                | 3.02867         | 7.37092                  | 2              | 1                  |
| 2       | 10.2183                | 0.00554615      | 10.594                   | 3              | 2                  |
| 3       | 13.1458                | 8.92474         | 12.8755                  | 4              | 3                  |
| 4       | 12.6071                | 15.6513         | 11.0032                  | 5              | 4                  |
| 5       | 8.49283                | 13.8386         | 8.95137                  | 6              | 5                  |
| 6       | 8.14832                | 15.7725         | 6.07229                  | 7              | 6                  |
| 7       | 4.77275                | 16.7729         | 2.61653                  | 6              | 7                  |
| 8       | 1.00842                | 20.5033         | 0                        | 4              | 6                  |
| 9       | 0.707103               | 11.5069         | 0                        | 2              | 5                  |
| 10      | 1.80381                | 5.74148         | 2.86964                  | 0              | 4                  |
| 11      | 1.91811                | 7.54872         | 5.9163                   | 0              | 3                  |
| 12      | 5.04093                | 1.79356         | 10.8983                  | 0              | 2                  |
| 13      | 9.30598                | -2.25047        | 12.7617                  | 0              | 1                  |
| 14      | 9.97999                | -3.21661        | 13.9563                  | 0              | 0                  |
| 15      | 13.1334                | 10.9153         | 15.8238                  | 1              | 0                  |
| 16      | 10.4975                | 8.15577         | 20.4312                  | 2              | 1                  |
| 17      | 8.47073                | 18.3628         | 19.4459                  | 3              | 2                  |
| 18      | 9.43791                | 20.7682         | 17.9473                  | 4              | 3                  |

|    |          |           |         |    |    |
|----|----------|-----------|---------|----|----|
| 19 | 4.42428  | 22.2144   | 15.9475 | 5  | 4  |
| 20 | 0.628476 | 19.0509   | 13.4509 | 6  | 5  |
| 21 | 0        | 11.0504   | 11.1666 | 7  | 6  |
| 22 | 1.78209  | 6.6406    | 11.1494 | 8  | 7  |
| 23 | 0.699504 | 0.645415  | 9.25968 | 9  | 8  |
| 24 | 3.71717  | 0.466499  | 7.98813 | 10 | 9  |
| 25 | 8.01673  | 1.02964   | 8.25953 | 9  | 10 |
| 26 | 8.24329  | 4.93348   | 11.4565 | 7  | 9  |
| 27 | 12.8318  | 7.85695   | 13.0195 | 7  | 8  |
| 28 | 13.0449  | 13.3149   | 10.0892 | 7  | 7  |
| 29 | 9.64621  | 13.1234   | 7.28521 | 8  | 7  |
| 30 | 6.48536  | 21.7683   | 3.28564 | 7  | 8  |
| 31 | 4.62062  | 20.5277   | 0       | 5  | 7  |
| 32 | 2.32909  | 13.7905   | 0       | 3  | 6  |
| 33 | 0        | 9.98748   | 0       | 1  | 5  |
| 34 | 0.530109 | 3.16461   | 2.59436 | 0  | 4  |
| 35 | 3.65632  | 3.81889   | 7.87655 | 0  | 3  |
| 36 | 3.93837  | -5.98031  | 8.04036 | 0  | 2  |
| 37 | 8.70987  | -0.321912 | 11.8091 | 0  | 1  |
| 38 | 11.2711  | 5.40958   | 19.4468 | 0  | 0  |
| 39 | 10.7757  | 2.73667   | 26.6818 | 1  | 0  |
| 40 | 12.5369  | 11.0985   | 27.9688 | 2  | 1  |
| 41 | 12.1179  | 20.4261   | 26.9707 | 3  | 2  |
| 42 | 9.49576  | 16.195    | 25.5617 | 4  | 3  |
| 43 | 4.58416  | 15.926    | 23.645  | 5  | 4  |
| 44 | 0.187635 | 13.3582   | 21.3778 | 6  | 5  |
| 45 | 0.964391 | 13.2815   | 18.6594 | 7  | 6  |
| 46 | 0.48124  | 11.6646   | 15.7565 | 8  | 7  |
| 47 | 1.97321  | 3.22228   | 15.7584 | 9  | 8  |
| 48 | 3.95273  | 3.14022   | 16.5105 | 10 | 9  |
| 49 | 5.95058  | 2.06262   | 17.1605 | 11 | 10 |
| 50 | 10.6716  | 2.9233    | 19.0493 | 12 | 11 |
| 51 | 11.9877  | 9.10238   | 16.8568 | 13 | 12 |
| 52 | 13.492   | 12.0646   | 11.4359 | 14 | 13 |
| 53 | 11.3289  | 17.3396   | 4.47183 | 13 | 14 |
| 54 | 6.92311  | 19.4265   | 0       | 11 | 13 |
| 55 | 4.21548  | 15.565    | 0       | 9  | 12 |
| 56 | 2.11136  | 13.541    | 0       | 7  | 11 |
| 57 | 0.379169 | 8.8046    | 0       | 5  | 10 |
| 58 | 1.24692  | 12.025    | 0       | 3  | 9  |
| 59 | 3.59657  | 7.59688   | 2.34747 | 1  | 8  |
| 60 | 5.8408   | -1.5146   | 3.97704 | 1  | 7  |
| 61 | 7.76567  | 3.42314   | 10.8346 | 1  | 6  |

|    |          |           |         |   |   |
|----|----------|-----------|---------|---|---|
| 62 | 8.49127  | 5.61661   | 17.814  | 1 | 5 |
| 63 | 10.2767  | 5.23682   | 25.1469 | 1 | 4 |
| 64 | 13.2475  | 15.7909   | 24.7581 | 1 | 3 |
| 65 | 11.6208  | 22.9262   | 24.2582 | 1 | 2 |
| 66 | 6.7349   | 26.071    | 23.7582 | 1 | 1 |
| 67 | 4.19219  | 23.9501   | 23.2582 | 2 | 1 |
| 68 | 3.0944   | 17.776    | 22.2739 | 3 | 2 |
| 69 | 0.650815 | 8.59402   | 22.6846 | 4 | 3 |
| 70 | 1.73165  | 11.5155   | 21.4837 | 5 | 4 |
| 71 | 2.91936  | -0.522771 | 21.1623 | 6 | 5 |

3. A graph showing temperature, precipitation, number of grain deer, height of the grain, and your own-choice quantity as a function of month number. Note: if you change the units to °C and centimeters, the quantities might fit better on the same set of axes.



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?
- The temperature pattern is not dependent on any other feature in this simulation except for random variation based that is applied to a cosine curve. The precipitation data is also independent of other features except it is a sine curve with added variation. However, when these two factors are both high there is a trend that the Height of the grain is also high. This is because the growth of the grain relies heavily on these two factors. Another

factor that contributes to the growth of the grain is when deer population and human population are low. This trend can be stemmed from the idea that the grains can grow without being eaten from deer.

- b. There is a trend that follows between humans and deer. As shown when deer are greater than humans, the human's population can only increase. This is the case as the deer can not reduce the human population. However, when the deer population becomes less than the human population and grain is low the population is reduced very quickly as a result of both being hunted by humans and not enough grain to feed.
- c. This shows that the quantity I added is affecting the simulation correctly as when there are more humans the deer population decreases, and the amount of grains increase from less deer pulling from that resource. It also works correctly, in the sense that the human population can only grow when the deer population is greater than the human population in order for enough food to go around.