*Simulation requirements*

|  |  |  |  |
| --- | --- | --- | --- |
| The program shall be able to plot the orbit of planets | Overall goal of the project | Screenshot of plot | No |
| The program shall be able to calculate the orbits of planet | Required in order to plot | Screenshot of different plots with different values for masses | No |
| The program shall be able to subtract two vectors. | Required for finding the distance between two vectors. | Test with test data. | No |
| The program shall be able to find the distance between two vectors. | Required for finding the unit vector between two vectors and the force exerted on a planet. | Test with test data. | No |
| The program shall be able to divide a vector by a scalar | Required for finding the unit vector between two vectors. | Test with test data | No |
| The program shall be able to find the unit vector between two vectors | Required for finding the force exerted on a planet. | Test with test data | No |
| The program shall be able to find the force a planet exerts on another | Required for finding the resultant force exerted on a planet. | Test with test data | No |
| The program shall be able to find the resultant force on a planet | Required for finding the acceleration of a planet. | Test with test data | No |
| The program shall be able to find the acceleration of a planet | Required for finding the velocity at half a time step away. | Test with test data | No |
| The program shall be able to find the velocity at half a time step away | Required for calculating the position vector at a time step away | Test with test data | No |
| The program shall be able to find the position vector of a planet a time step away | Required for updating the positions of the planets as part of the simulation. | Test with test data | No |

*Feature requirements*

|  |  |  |  |
| --- | --- | --- | --- |
| Criteria | Justification | Validation | Optional? |
| The program shall allow the user to change the orbits | Overall aim of the project | Screenshot of user interface.  Video of user using program to change orbit. | No |
| The program shall allow the user to change the mass of planets | Overall aim of the project | Screenshot of user interface  Video of user interacting with the menu to change the mass | No |
| The program shall allow the user to change the gravitational constant | Overall aim of the project | Screenshot of user interface Video of user interacting with menu to change the gravitational constant | No |
| The program shall be accurate within 10% of actual value | Accuracy is more important than speed, as justified in the stakeholder analysis | Plotting of known planets and cross-comparison.  Using the program to calculate the error using known formulas for the algorithm that I use.  Test with test data. | No |
| The advanced settings such as gravitational constant shall be tucked away into an advanced menu that the user can open | To prevent cluttering of the main window, and optimising the user experience as justified in the stakeholder analysis.  An optimisation objective, not a main objective. | Screenshot of user interface  Video of user interacting with the advanced menu | Yes |
| The program shall allow for the user to store what they have created | An option for the user to save what they created can be useful, but not necessary for the overall project as explained by Steven | A screenshot of the user interface A video showing the user interacting with the saving feature | Yes |
| The program shall allow for the user to share what they have created | The application may choose to use webserver hosting and user login systems to allow for the users to look at what other people have created | Screenshot of the user interface  Video of a user loading up what other people have made | Yes |
| The user interface shall be intuitive and easy to use | A clean user interface can make the user experience better.  An optimisation objective, not a necessity | Questionnaire/interview with stakeholders for opinion  Screenshot of the user interface | Yes |
| If implementing a user login system:   The database shall be secure and store the passwords as hashes | For security,  not very important for this task as it depends on whether I implement a system for multiple users | Screenshot of code  Screenshot of example password stored in database. | Yes |
| The program shall take no longer than 15 seconds to start up. | As discussed with Steven this may annoy the users. | Video of starting the application showing that it does not take longer to start | Yes |
| The program shall be able to allow for the user to log in to the system | Required for the users to load what they have created | Screenshot of login menu | Yes |

*GUI Requirements*

|  |  |  |  |
| --- | --- | --- | --- |
| There should be a play button for the user to press to start the simulation | Part of the GUI design | Screenshot of button | No |
| There should be a textbox or scrollbar for the user to adjust the mass of planets | Part of the GUI design | Screenshot of textbox/scrollbar | No |
| There should be a textbox or scroll bar for the user to change the gravitational constant | Part of the GUI design | Screenshot of textbox/scrollbar | No |
| The planets should be displayed as circles on the screen | Part of the graphics design | Screenshot of planets | No |
| There should be a button to open up an advanced menu for the user to adjust additional settings (if applicable) | Part of the GUI design, and something that I discussed with Steven | Screenshot of the menu | Yes |
| There should be a button to create and delete planets | To allow for user freedom | Screenshot of the feature working | No |
| There should be a scrollbar or text input field to change the time step size | To adjust the simulation speed | Screenshot of the feature working | No |