UNITED ARAB EMIRATES
MINISTRY OF EDUCATION

Computer Science – Term 1 (2020-21)
Grade 10 – Checkpoint 3
Project model answer

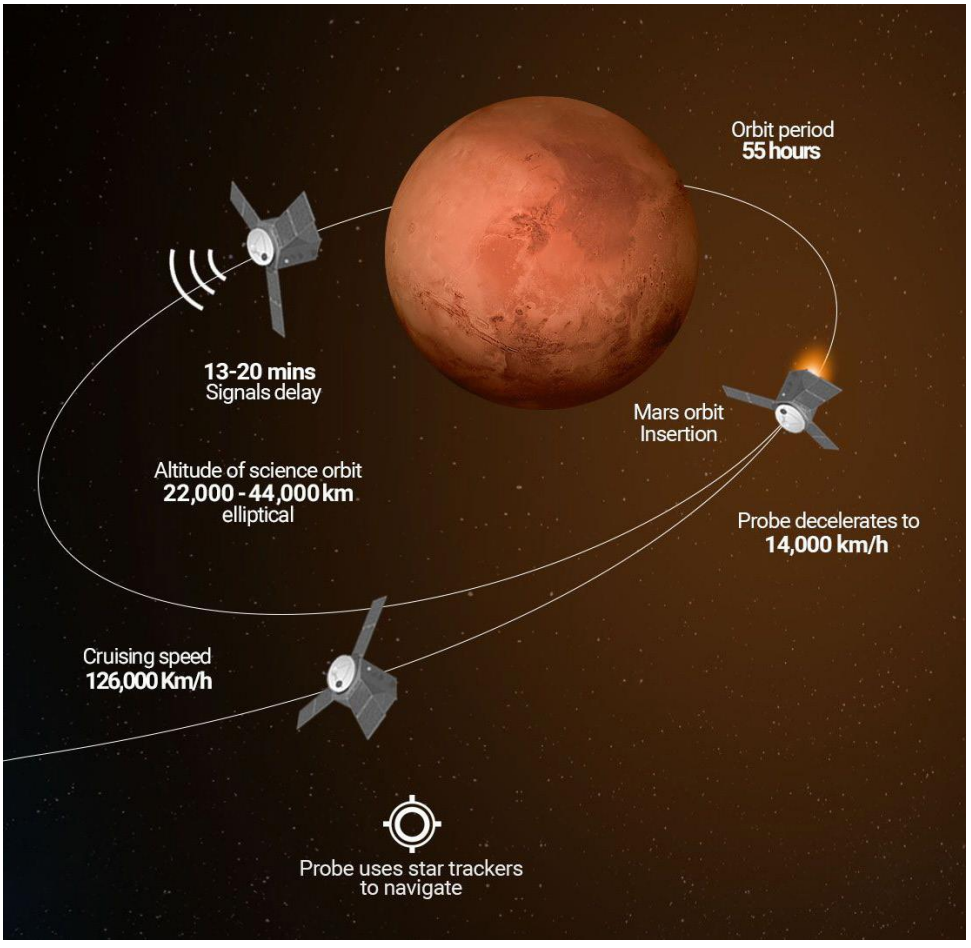
Please note:

- This document is for teacher's guidance to support the marking of student's responses.
- Please use the project rubric and mark recording sheet to record individual students' marks.

Project Task 1: Hope probe orbit

UAE launched the Hope probe on 15 July 2020 to explore Mars. It takes 200 days to travel from Earth to Mars. The Hope probe will be used to study planet Mars' atmosphere and to check for any interesting events in Mars that could answer scientific questions. It will also be used to determine the types of rocks there and to find out if there are any living creature or water sources.

The probe should maintain a known orbit around mars, as shown in the figure. In this task, you will find a way to make sure the probe is following its orbit around mars by using the knowledge you learnt through this term. The probe position from the orbit will be given by the x, y, z values. These values should be 0,0,0 to stay in its orbit. You will work in a group to use the knowledge you learnt this term to design a system that will control the probe position.



i) Suggest a way to control the probe movement to keep its orbit around mars.

To control the probe movement and maintain its position we need to have some sensors, or position systems like (GPS) to detect position.

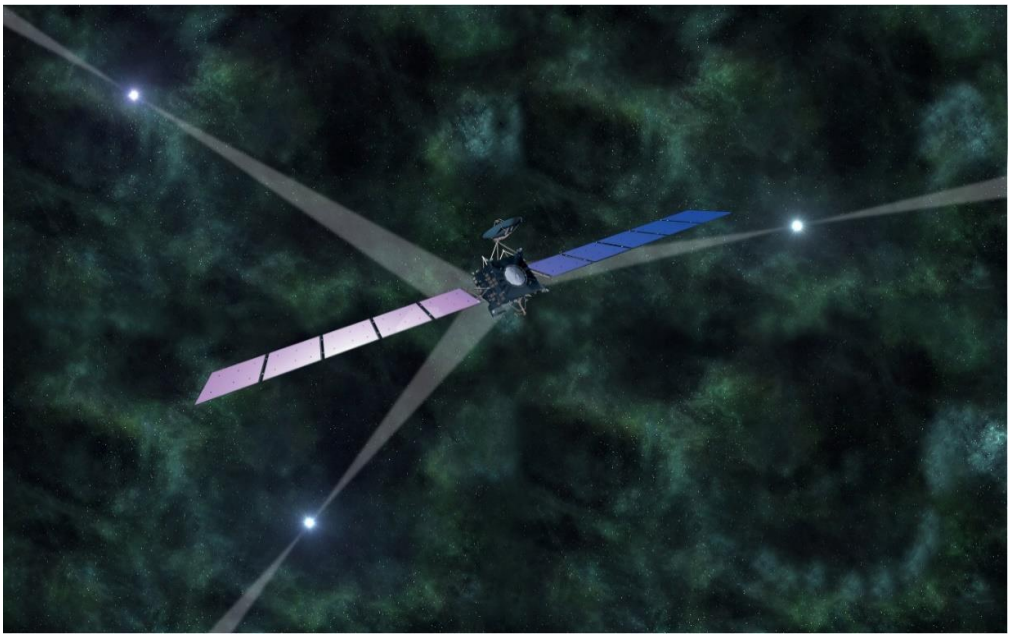
Then a reinforcement learning will be used to control the probe position using some rewards and punishments system.

ii) What sensors will be used to in your design? And how it will be used?

To determine the distance between the probe and Mars an ultrasonic sensor can be used. Ultrasonic sensor will fire a signal that will hit mars and come back to the receiver side of the sensors. Then the time taken for the signal to come back will help in determine the distance from mars.

Another war too determine the position in space is using Deep Space Network, Where the sensors will be antenna that receive the signal of 3 radio antenna around the world to determine the position and speed of the probe. This work similar to the Global Position System (GPS). Where the distance from each antenna will be known and from that you can calculate the exact position.

https://futurism.com/how-do-scientists-find-directions-in-space
The link above provide more explanation on how a probe position can be found in space



iii) Can a motor be used in space to control the probe position? Why?

Motors cannot be used in space to move a probe or spaceship.

The reason is because motors relies of pushing some form of matter like air, water, or land to move.

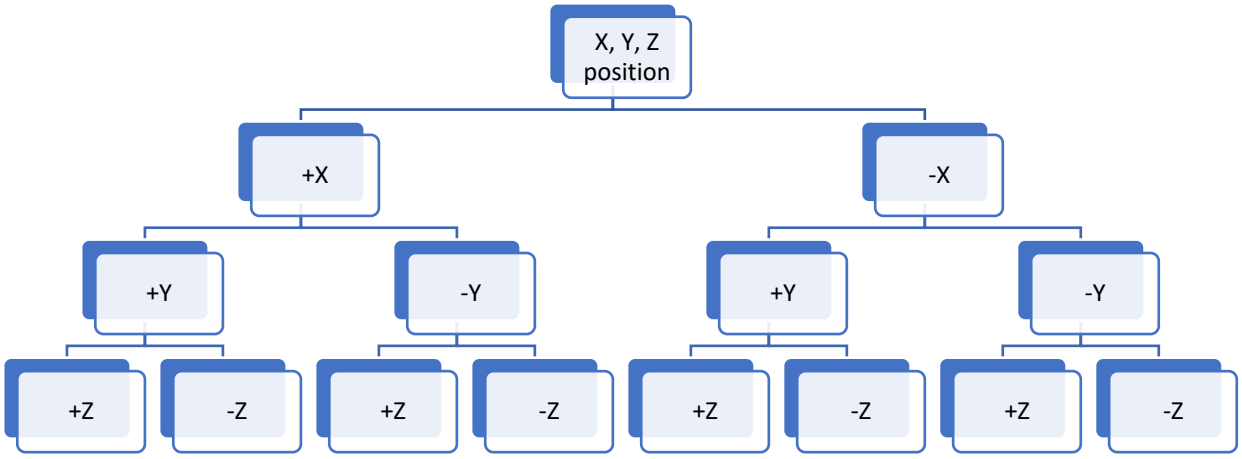
In space its only vacuum. No air or other matter to push the probe.

Rockets and engines in space behave according to Isaac Newton's third law of motion: Every action produces an equal and opposite reaction.

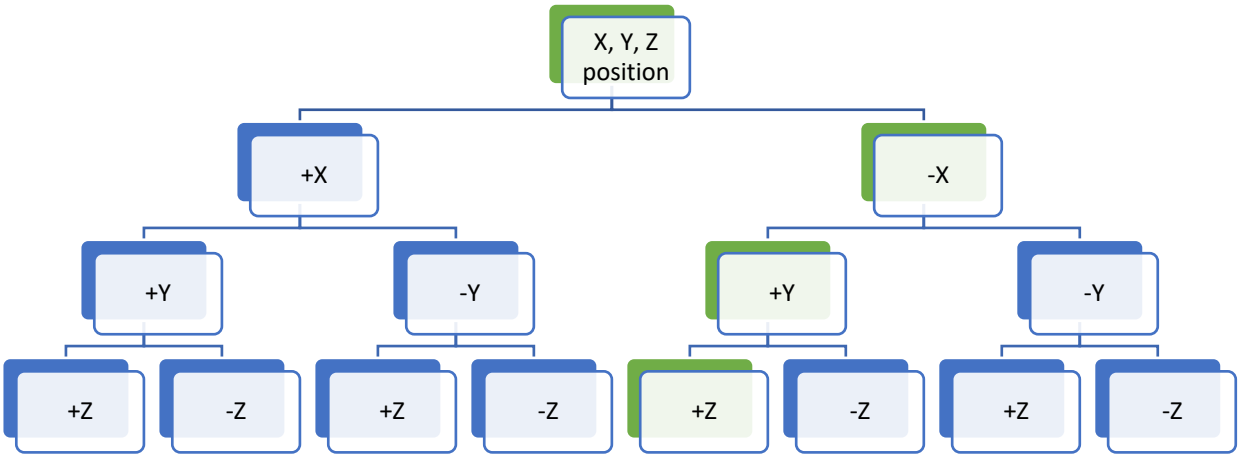
When a rocket shoots fuel out one end, this propels the rocket forward — no air is required.

https://www.livescience.com/34475-how-do-space-rockets-work-without-air.html#:~:text=Rockets%20and%20engines%20in%20space,forward%20%E2%80%94%20no%20ai

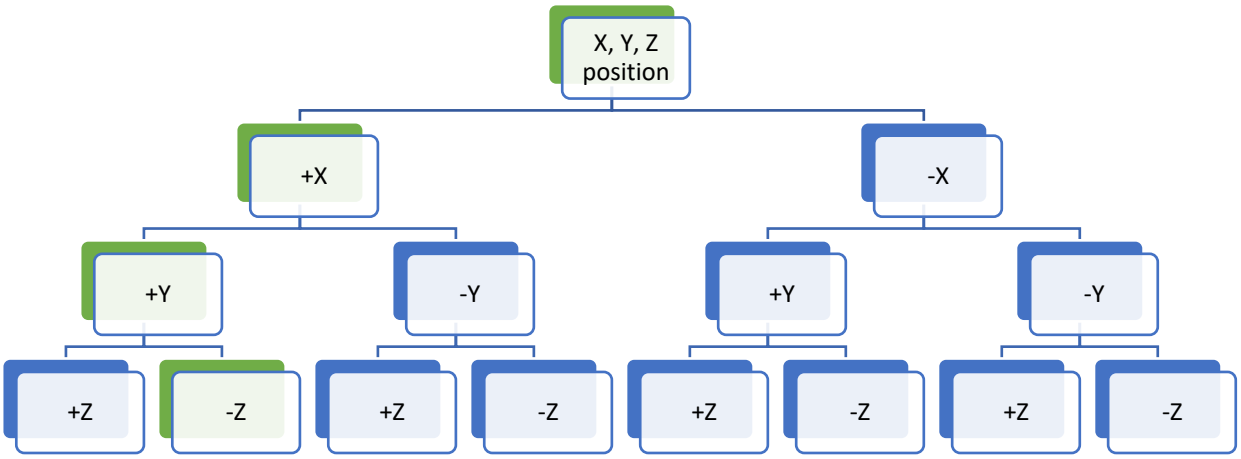
iv) Represents the possible movements that the probe can take in order to maintain its x, y, z position on its orbit.



v) If the probe's position from its orbit has changed to +X, -Y, -Z, what path in the tree will move the probe closer to its orbit?



vi) If the probe's position from its orbit has changed to -X, -Y, +Z, what path in the tree will move the probe closer to its orbit?



The probe should always try to maintain the position to 0,0,0 from the orbit.
That is why when the value of X position is (+) positive, the system will reduce X by 1 each time.

vii) Write the pseudocode for the probe to maintain its orbit.

```
Do always

    Read the X,Y, Z position values

    If X bigger than 0
        Reduce X
    Else if X less than 0
        Increase X

    If Y bigger than 0
        Reduce Y
    Else if Y less than 0
        Increase Y

    If Z bigger than 0
        Reduce Z
    Else if Z less than 0
        Increase Z
```

viii) To sell your design to the customer, you have to describe the problem and explain how your design will solve the problem.

Explain your design

ix) Many other companies do provide a similar project to solve the problem. Why should they customer choose your design among the others? What addtianl features and services you provide?

Explain your design

Rewards and risks of your business

You will have to study the rewards and risks of creating this business. In other words, what you will get if your idea was selected by the customer and how you will invest in the given opportunity. And what can happen if you did not succeed in convincing the customer in your idea, and how you can enhance it in the future.

i) Discuss the rewards that you can get of your business and how it can help you grow your company bigger.

If your design is accepted, you will he enough fund to open new departments in your company. Which could lead to more researchs and designs for different future projects

Also, by providing the perfect service to your first customer you build a relationship that could lead do future work together.

Moreover, You could open new offices in different countries to seek international opportunities with new entities.

ii) Discuss the risks of what can happen if you did not succeed in marketing or executing your idea.

In case your idea was not a success, you will lose the time and money paid to prepare the prototype and demonstrate the idea.

This might have an impact on your faniancatl support for future projects and designs.

Also, your opponnat from the other company that succeded in marketing their project will have a better chance of working with the same client in future opportunities.