NELSON MANDELA
UNIVERSITY

END OF MODULE ASSESSMENT 2021

MODULE DESCRIPTION	:	**Virtual Reality**
MODULE CODE	:	**WVRV402**
FACULTY	:	**Science**
QUALIFICATION	:	**B.Sc. Hons, B.Com Hons**
HOURS	:	**3**
TOTAL	:	**100**
PAGES	:	**7 (Including this cover)**
ADDENDUMS	:	**none**
EXAMINER	:	**Dr D. Vogts**
MODERATOR	:	

1. **Dr E. van Wyk (Tshwane University of Technology)**

INSTRUCTIONS   :

1. **This is an open book assessment.**
2. **Answer all the questions providing adequate details.**
3. **Your answers must be in the same order as the questions below.**
4. **Submit your answers, as a PDF, on the module Learn page before the due date and time. Be sure to include you name and student number.**
5. **Late submissions will *not* be accepted.**

No Man's Sky is a game set in a *procedurally-generated universe*, where everything from the solar systems, to the planet's terrain, flora and fauna are all randomly generated – meaning every play through is different.

The player is able to have large-scale battles between star ships in space, but can also land on any planet and walk around on its surface, seeing individual plants, animals and rocks up close and personal. It is available on a number of platforms, including PS4, PS5, Steam and Xbox One.

Watch the video in the assessment folder, or on YouTube here, to get a feel for the world and game play.

1) The game can currently manage 8-32 players in a multiplayer game. In other words, 8-32 people share the   (10)
    same randomly generated universe.

    If the developers wanted to have *hundreds* of players inhabiting the *same* instance at the *same* time, *what* changes do you think would need to be made (from a networking and universe consistency point of view) and *how* do you think this could be implemented (using what you learnt in the module)?

    If specific techniques are mentioned in the discussion, explain how these techniques work.

2) Movement in the game includes walking, jumping, swimming and flying in a space ship and is very important   (6)
    as the game revoles around combat, exploration and movement. Poor internet connections can negatively affect the experience and result in jerky movement of other players.

    Discuss how the jerky movement could be avoided or at least reduced. Specifically discuss how flight and surface movement could be made to appear smoother.

The rendering of the universe, while not realistic (in terms of what we see in the real world), has a lot of detail. Watch the videos again and pay special attention to the clouds, landscape, objects placed on the landscape, weather effects (rain and gusts of wind), special effects (motes of dust) and vegetation (grass and flowers), as well as the creatures that inhabit the world (including "birds", "fish", antelopes, and dinosaurs).

3)   The game has many different types of vegetation that are randomly generated, from small to large plants,   (17) such as grass, bushes, and trees. The vegetation can be viewed from very close (centimeters away), to very far away (hundreds of meters to thousands of kilometers).

At approximately 0:30 in the video, there is a sequence illustrating some of the different types of vegetation that can be generated.

Discuss how a *tree* can be rendered *efficiently* from up close to *very* far away.

4)   (6)

Clouds feature in the game. They appear to have *some* volume and the player is able to fly *through* them and skim *over* them. Discuss how you think these clouds could've been implemented. Use techniques discussed in the module to help your discussion. If you think a particular technique was used, be sure to briefly discuss how it works.

5)   (10)

Particle systems have been used for a number of effects in the game, including rain, sparks and trails. In the picture above (at about 2:35 in the video), space ships are shooting at targets on the planet surface, which explode in a ball of smoke and flames.

Discuss how particle systems work *and* how the explosion could be implemented.

6)   (10)

Most of the scenes in No Man's Sky are outdoors (in space and on a planet's surface). It is possible to fly seamlessly from outer space, down through the planet's atmosphere, land on the surface and walk around. From about 2:10 in the video, this can be seen in action.

Discuss issues related to achieving this; and techniques that could be used in the game to overcome these issues and make the game run smoothly.

Be sure to consider *all* the things that could be happening while this happens, not just a *single* aspect. It is *not* necessary to discuss multiplayer aspects when answering this question.

7)   At about 1:10 in the video, a large predator (a dinosaur) comes crashing through the trees chasing a *herd* of "antelope" that scatter and run away over the nearby hill.

7.1)   Discuss how you could implement the AI to make the herd of "antelope" scatter, trying to avoid the predator, not bumping into each other or trees and rocks, while "sticking" together in a cohesive flock.   (7)

7.2)   Discuss how the AI for the large predator dinosaur chasing the "antelopes" could be implemented.   (2)

7.3)   If the game was able to generate a *pack* of predators that attempts to divide a herd (possibly multiple times), then surrounds the remaining prey to capture them – how could this type of AI be implemented?   (10)

8)   The developers decided that they wished to make a *Mixed Reality* version of the game.   (12)

Discuss how you think this could work, being sure to include a discussion on:

- where on the Mixed Reality scale would you choose and why?;

- the hardware and techniques required; and

- user interaction techniques that would be appropriate (and how they would work).

9) During the module, you completed two large assignments, which were two of:

- Virtual Reality;

- Augmented Reality; or

- Artificial Intelligence assignments.

9.1) Give a one paragraph overview of the theme/concept of each of your submissions and what your implementation did (for the external moderator). Be sure to upload one or more videos showcasing your applications. This will not count for marks, but you will use this when answering the following questions.   (0)

9.2) Discuss what you **learnt** during the process of implementing these assignments. Be sure to highlight the things that **worked really well**, as well as those that you **struggled** with.   (6)

10) Unity3D makes use of *prefabs*. When instantiating a prefab, Unity3D most likely uses a variation of the *factory* pattern. Briefly explain what the *factory* pattern is and how it works.   (4)

End of EMA