6 Further Graphics (pb355)

(*a*) The challenge of simulation sickness (sim sickness) in Virtual Reality is a crucial hurdle in creating engaging virtual content.

(*i*) When it comes to avoiding sim sickness, what is the cardinal rule of VR? [1 mark]

(*ii*) Succinctly explain the triggers and effects of sim sickness. [2 marks]

(*iii*) List the constraints that sim sickness imposes on user interface design in VR. For each constraint give a one-sentence explanation of how developers must adapt to compensate. [5 marks]

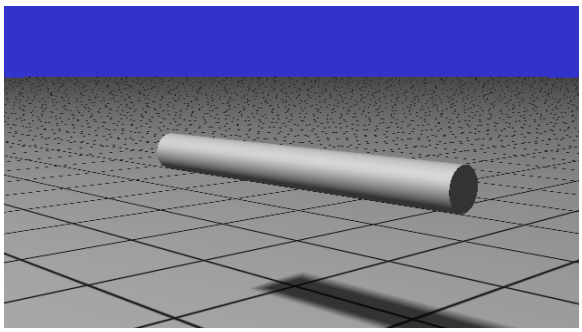
(*b*) A mathematician tells you that a mystery shape is composed of polygons forming a closed, connected, manifold mesh without border. They claim that the mesh has 832 vertices, 1,648 edges, and 600 faces. The mathematician wants to know if it is possible that there is a loop of connected polygon edges in the mesh which, if all of those edges were cut apart, would *not* split the mesh into disconnected parts.

(*i*)
- If you say no, they will want to know why.
- If you say that you cannot answer, they will want to know why not.
- If you say yes, they will ask you why; and then they will ask you to find the greatest possible number of such loops that could simultaneously be cut in the mesh.

What do you tell them? [5 marks]

(*ii*) If the mathematician had instead said that the mesh had 832 vertices, 1,648 edges, and 900 faces, would your answer to their question have been different? If so, how? [2 marks]

(*c*) Implement a Signed Distance Field method `cylinder()` which returns the signed distance from point p to a finite cylinder segment. The cylinder should go from point a to point b with flat ends and radius r.



```
float cylinder(vec3 p, vec3 a, vec3 b, float r) {
   // ...
}
```

[5 marks]