**This question paper consists**

**of 2 printed pages each**

**of which is identified by the Code** **COMP5812M**

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School of Computing

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**COMP5812M: Foundations of Modelling & Rendering**

Answer all TEN questions

Time allowed: 2 hours

**Question 1**

How do we determine whether a mesh is manifold? Give details of how you test this in code, assuming that the mesh is stored as a directed-edge structure. **[5 marks]**

**Question 2**

Assume that you have a mesh M including texture coordinates for each vertex v, and that you have built a function that computes the lighting at any given point on the mesh M. How would you use this function to store the lighting in a texture (i.e. as a light map?) **[5 marks]**

**Question 3**

Given a triangle ABC with colours (1.0, 0.0, 0.5), (0.6, 0.8, 0.4) and (0.5, 1.0, 0.5), find the colour at the point with barycentric coordinates (0.1, 0.4, 0.5). **[5 marks]**

**Question 4**

Sketch the major stages of the Projective (Fixed Function) Pipeline, and describe what each stage does. **[5 marks]**

**Question 5**

Given a rayanda triangle in space, describe how to find the intersection of the ray and the triangle. Where possible, express your answer mathematically.  **[5 marks]**

**Question 6**

For the greyscale image: **[5 marks]**

0 0 0 0 0 0 0 0 0

0 10 0 10 0 10 10 10 0

0 10 0 10 0 0 10 0 0

0 10 10 10 0 0 10 0 0

0 10 0 10 0 0 10 0 0

0 10 0 10 0 10 10 10 0

0 0 0 0 0 0 0 0 0

show the result of applying the filter:

0.1 -0.2 0.1

-0.2 1.4 -0.2

0.1 -0.2 0.1

**Question 7**

Give a brief definition &/or description of the following optical phenomena: **[5 marks]**

1. Emission
2. Reflection
3. Refraction
4. Scattering
5. Absorption

**Question 8**

For each of the optical phenomena in Question 7, explain how they are implemented in a recursive raytracer.  **[5 marks]**

**Question 9**

How does forward rendering work? **[5 marks]**

**Question 10**

Give a brief high-level description of the major routines in a recursive raytracer. **[5 marks]**

**[50 marks total]**