Student name: _____

Student number: _____

The UNIVERSITY of NEWCASTLE

FACULTY of ENGINEERING and BUILT ENVIRONMENT

SCHOOL of ELECTRICAL ENGINEERING & COMPUTING

Comp 3320/6370   Computer Graphics

DIAGNOSTIC MATH TEST

Semester 2, 2018

Examination duration: 30 minutes

This paper is for Callaghan students

Instructions:

1. Materials supplied by examination:

   (a) Examination question paper.

   (b) Six empty answer pages attached to the question paper.

2. Clearly show the number of the question you are answering.

3. Write your name and student number on the top right corner of the cover page before you begin.

4. Calculators are not required.

5. Please hand in this examination question paper together with the answer pages at the conclusion of the examination.

Examiner: A/Prof Stephan Chalup
Discipline: Computing and Information Technology

Comp3320/6370 Computer Graphics   Semester 2, 2018

Question 1: **Derivatives**

What is the derivate of $(\sin(x) \cdot \cos(x))^2$?

Question 2: **Complex numbers**

What is the product of the two complex numbers $(3 + 2i)$ and $(1 + 4i)$?

Question 3: **Intersection of a Line and a Plane**

Let $p \subset \mathbf{R}^3$ be the plane which is orthogonal to the vector $\vec{n} = (1, 0, 1)$ and which contains point $B = (1, 2, 2)$. Further let g be the line that contains point $A = (0, 1, 1)$ and has direction vector $\vec{c} = (1, 2, 0)$. Calculate the **hit point** P_{hit} where plane p and line g intersect.

Question 4: **Products of vectors**

Let $\mathbf{v} = (2, 2, 1), \mathbf{w} = (1, -2, 0) \in \mathbf{R}^3$ be two vectors. Calculate or explain the result of:

(a) The dot product $\mathbf{v} \cdot \mathbf{w}$

(b) The cross product $\mathbf{v} \times \mathbf{w}$

(c) $(\mathbf{v} \times \mathbf{w}) \cdot \mathbf{v}$

(d) Calculate the length of $\mathbf{v}$ (i.e. the Euclidean norm of $\mathbf{v}$).

Question 5: **Matrices**

Consider the following two matrices:

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 0 \\ 2 & 0 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Calculate the determinant $\det(A)$ and the matrix product $A \cdot B$.

Question 6: **A curve**

Describe or draw the curve that is given by the following parameterisation

$$c : [0, 1] \longrightarrow \mathbf{R}^3, \ \alpha \mapsto c(\alpha) = \begin{bmatrix} \cos(2\pi\alpha) \\ \sin(2\pi\alpha) \\ \alpha \end{bmatrix}$$

Comp3320/6370 Computer Graphics   Semester 2, 2018

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