Letterkenny I.T., BSc Games Development, Year 1, Games Programming 1, Spring Term 2008. Lecturer: J.G. Campbell

Assignment 2, Deadline for paper copy Wed. 27th February 2008, 2.30pm. Demonstrations must be completed by Monday 25th Feb. 5.00pm (Group A), Wed. 27th Feb. 1.00pm (Group B). Worth 12% of module marks.

Late assignments without documented extenuating circumstances **will lose 10% of marks per day or part of day late. Those seven days late will receive zero marks**. If you have extenuating circumstances, you should contact me as soon as possible; in particular, be careful about wasting time on completing an assignment only to hand it in well after the deadline; whether you have valid reasons or not I cannot give any marks for work handed in after outline answers have been handed out or discussed in class.

New Computing Department Rules. Assignments must typed and neatly presented and spell-checked. Sloppily presented work will be severly penalised or returned for correction and resubmission.

Poor layout of programs will be penalised.

Expect to be questioned about the content of assignments.

Please use only one side of the page. There is no need for ornate front sheets; simply include the heading above (including my name), and your own name. A staple at the top left corner is the preferred binding – I can staple them if you wish. There is no need for plastic or other covering. Please use the Computing Department cover sheet and signed declaration.

For numerical answers, where appropriate, show your working; a numerical answer written down with no explanation of working is likely to get zero marks.

There is a team project on game construction at the end of the module worth 24% of the module marks. Students whose performance on courework is poor, or whose attendance is poor, will not be allowed to participate in this team project and will be given individual work to do instead.

Software will be available in my public folder and on my website `www.jgcampbell.com/bscgp1`.

1. *50% of marks for demonstration.*
   (a) Compile and execute `Trig.java` (available on my public folder in `bscgp1\progs\ch02maths\`).
   (b) Obtain some graph paper and draw a properly annotated graph of $\cos ang$ for $ang = 0, 10.0, 20.0, \cdots 360.0°$. Include the table in your submitted assignment.

   [20 marks]

2. *50% of marks for demonstration.*
   (a) Add code to `Trig.java` to print a table of values of $\sin ang$ for $ang = 0, 10.0, 20.0, \cdots 360.0°$.
   (b) Obtain some graph paper and draw a properly annotated graph of $\sin ang$ for $ang = 0, 10.0, 20.0, \cdots 360.0°$.

   [20 marks]

3. Add code to `Trig.java` to verify eqn. 1 for $a = 0, 10.0, 20.0, \cdots 360.0°$. Include the table in your submitted assignment.

$$\sin^2 a + \cos^2 a = 1. \tag{1}$$

   [20 marks]

4. Coordinate geometry, mathematics notes section 2. Please use graph paper or squared paper for the diagram.

   (a) Draw a diagram like Figure 2.1 and mark the following points on it: $P(x = 1, y = 2), Q(5, 2), R(5, 5)$;

   [8 marks]

   (b) What is the distance between P and Q?

   (c) What is the distance between Q and R?

   (d) What is the distance between P and R?

   (e) What is the distance between Q and P?

   (f) What is the distance between R and Q?

   (g) What is the distance between R and P?

   [$6 \times 2 = 12$ marks]

5. Vector arithmetic.

$$\mathbf{e}_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \tag{2}$$

$$\mathbf{e}_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \tag{3}$$

$$\mathbf{a} = \begin{bmatrix} 4 \\ 0 \end{bmatrix} \tag{4}$$

$$\mathbf{b} = \begin{bmatrix} 0 \\ 3 \end{bmatrix} \tag{5}$$

$$\mathbf{c} = \begin{bmatrix} 3 \\ 2 \end{bmatrix} \tag{6}$$

$$\mathbf{d} = \begin{bmatrix} -2 \\ 3 \end{bmatrix} \tag{7}$$

$$\mathbf{f} = \begin{bmatrix} 1 \\ 3 \end{bmatrix} \tag{8}$$

$$\mathbf{g} = \begin{bmatrix} -1 \\ -3 \end{bmatrix} \tag{9}$$

   (a) (i) Compute $\mathbf{a} + \mathbf{b}$.

   [2 marks]

   (ii) Verify your answer to (i) using either the *head to tail rule* or the *parallelogram rule*. You must provide a diagram.

   [2 marks]

   (iii) Compute $\mathbf{f} + \mathbf{g}$

   [2 marks]

   (iv) Compute $3\mathbf{f}$

   [2 marks]

(b) The *scalar* or *dot* product of two vectors can be expressed in two ways:

$$\mathbf{u} \cdot \mathbf{v} = |\mathbf{u}||\mathbf{v}| \cos\theta, \tag{10}$$

where θ is the angle between them, or in terms the sum of products of components,

$$\mathbf{u} \cdot \mathbf{v} = (u_x v_x + u_y v_y). \tag{11}$$

When u_x, u_y, v_x, v_y denote components with respect to an orthonormal basis, both equations give the same result.

(i) Compute $\mathbf{f} \cdot \mathbf{c}$.

[2 marks]

(ii) Compute $\mathbf{f} \cdot \mathbf{e}_1$.

[2 marks]

(iii) Compute $\mathbf{a} \cdot \mathbf{b}$.

[2 marks]

(iv) Compute $\mathbf{d} \cdot \mathbf{f}$.

[2 marks]

(v) If $\mathbf{u} \cdot \mathbf{v} = 0$ and neither of the magnitudes of $\mathbf{u}$ or $\mathbf{v}$ are zero, what can you say about the angle between $\mathbf{u}$ and $\mathbf{v}$?

[2 marks]

(c) (i) Compute the magnitude of $\mathbf{a}$, $|\ \mathbf{a}\ |$.

[2 marks]

(ii) Compute the magnitude of $\mathbf{f}$, $|\ \mathbf{f}\ |$.

[2 marks]

(d) Compute the unit vector $\hat{\mathbf{f}}$ which is in the same direction as $\mathbf{f}$ but has unit magnitude. Check your result.

[3 marks]