

# CPSC 314

## Assignment 0

Due 4pm, Friday September, 23 2005  
(handin box in the CICSR basement)

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name: \_\_\_\_\_

Student Number: \_\_\_\_\_

Theory	/ 5
Question 1	/ 0
Question 2	/ 1
Question 3	/ 1
Question 4	/ 1
Question 5	/ 1
Question 6	/ 1
Question 7 (bonus)	/ 2
Programming Assignment	/ 5
TOTAL	/ 10

1. (0 points) Print the plagiarism policy form from the web (<http://www.ugrad.cs.ubc.ca/~cs314/Vsep2005/plag.html>). Sign it and submit with your assignment. **Assignments without the form, will not be checked.**
2. (1 point) Vectors

$$a = \begin{pmatrix} 1 \\ 3 \\ -1 \end{pmatrix} \quad b = \begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix}$$

- compute  $a \cdot b$ ,
- compute  $a^T b$
- compute  $a \times b$
- compute  $b \times a$

3. (1 point) Matrices

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 0 & 4 \\ 3 & -1 & 2 \end{pmatrix} \quad B = \begin{pmatrix} 3 & 1 & 6 \\ 1 & 2 & 2 \\ 1 & -1 & 2 \end{pmatrix}$$

- Compute  $C = AB$ .
- Does  $AB = BA$ ?
- Given the vector  $a$  from the previous question, compute  $c = Aa$ .
- Given the vector  $a$  from the previous question, compute  $d = a^T A$ .

## 4. (1 point) Normals and Planes

$T$  is a triangle in 3D with vertices  $P_1 = (1, 0, 0)$ ,  $P_2 = (2, 0, 1)$  and  $P_3 = (2, 2, 2)$  (counterclockwise around the normal).

- Compute the normal to  $T$ .
  
  
  
  
  
  
  
  
  
  
- Compute the area of  $T$ .
  
  
  
  
  
  
  
  
  
  
- Compute the implicit plane equation  $Ax + By + Cz + D = 0$  for the plane that  $T$  lies in.

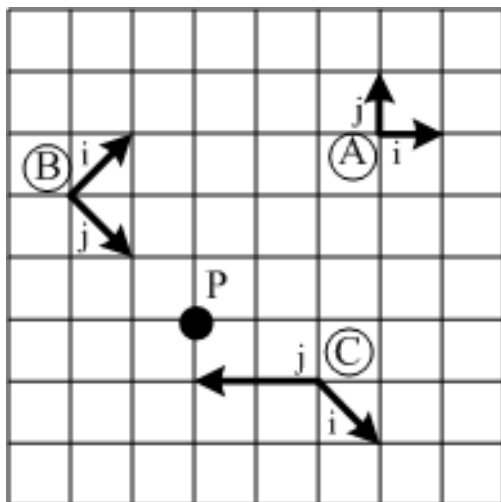
## 5. (1 point) Segments and Lines

Given two segments in 2D:  $S_1$  from  $(0, 1)$  to  $(-1, 2)$  and  $S_2$  from  $(0, 0)$  to  $(2, 2)$ ,

- Does the point  $P = (0, 1)$  lie on  $S_1$ ?
  
  
  
  
  
  
  
  
  
  
- Do  $S_1$  and  $S_2$  intersect? If yes, compute the intersection, if no, explain.

## 6. (1 point) Frames

Specify the coordinates of point  $P$  with respect to coordinate frames A, B and C.



## 7. (2 points) BONUS:

Given an arbitrary point  $P$  and a triangle  $(P_1, P_2, P_3)$  in 2D describe an algorithm to determine if  $P$  is inside the triangle.

## 8. (5 points) Coding

This is an exercise to get you started on OpenGL. Experiment more on your own if you like. Many additional models in OBJ format can be downloaded from the web (you can use Google to find them).

- Download and untar `a0.tar.gz`
- The department Linux machines should have all the libraries you need for the assignment. If you work at home (Linux or windows) you need to install glut libraries and headers on your machine. Check

[http://www.opengl.org/resources/libraries/glut/glut\\_downloads.html](http://www.opengl.org/resources/libraries/glut/glut_downloads.html)  
for installation instructions.

- Build the executable. In Unix use the provided makefile. In Microsoft VS you will need to create a project and add the existing files. (1 point)
- Run the program with an obj file name as the first command line parameter (it will crash if no obj file is provided). For example: `./openglDemo shuttle.obj`
- Make the following changes:
  - Change model color to blue (.5 points)
  - Change background color to white. (.5 points)
  - Change the rotation axis to be the Z axis. (.5 point)
  - Change the polygons drawing to draw simultaneously the wireframe (in blue) and the solid model (in red). (2 points)
  - Have the space key toggle the animation on and off. (.5 points)

#### Hand-in Instructions

- Create a root directory for our course in your account, called `cs314`. Later all the assignment handin files should be put in this directory.
- For assignment 0, create a folder called `assn0` under `cs314` and put all the source files that you want to handin in it, including the “makefile”. Don’t use subdirectories – these will be deleted. NOTE: we only accept README, makefile and files ending in `cpp`, `c`, `h`, `txt`.
- The assignment should be handed in with the exact command:

```
handin cs314 assn0
```

This will handin your entire `assn0` directory tree by making a copy of your `assn0` directory, and deleting all subdirectories! ( If you want to know more about this handin command, use: `man handin`.)