Graphics Systems and Interaction

Special Season 2015-09-07

N.o _____ Name _____

Assessment duration: 75 minutes
Value of each question: marked with brackets
Multiple choice questions: each wrong answer deducts 1/3 of the question's value

Theoretical Part **30%**

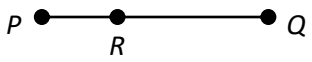
a. **[2.5]** The visualization, on the screen of a common computer, of a SVG (Scalable Vector Graphics) image

   i. Is only possible with systems equipped with a graphics processing unit (GPU)
   ii. Requires sophisticated pattern recognition techniques
   iii. Requires a rasterization operation
   iv. None of the above

b. **[2.5]** Projective transformations

   i. Require the projection center to be always positioned on the origin
   ii. Are not compatible with the use of homogeneous coordinates
   iii. Preserve affine combinations
   iv. None of the above

c. **[2.5]** Given two different points P and Q and the affine combination $R = (1 - \alpha)P + \alpha Q$, what value should be assigned to α so that point R gets positioned two times closer to P than to Q?



   i. $\alpha = -0.33$
   ii. $\alpha = 0.33$
   iii. $\alpha = 1 - 0.33$
   iv. None of the above

d. **[2.5]** Which of the following polygon mesh coding techniques avoids drawing each edge twice?

   i. Explicit and pointers to a vertex list
   ii. Pointers to a vertex list and pointers to an edge list
   iii. Pointers to an edge list and Winged-Edge
   iv. None of the above

e. **[2.5**] Which one of the following equations corresponds to the parametrization of a origin-centered unit sphere?

i. $x^2 + y^2 - z^2 = 0$

ii. $x^2 + y^2 + z^2 - 1 = 0$

iii. $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} = 1$

iv. None of the above

f. **[2.5]** Lighting a scene with a positional light source that emits light in all directions requires that

i. The OpenGL light model is enabled
ii. The position of the light source is specified in homogeneous coordinates with *w* = 0
iii. The cutoff angle is 90º
iv. None of the above

g. **[2.5]** Which values should the attenuation factors exhibit in order to simulate a situation in which the reflected light intensity remains unaltered when the distance between the light source and the lit object increases three times?

i. Constant factor = 1.0; linear factor = 1.0; quadratic factor = 0.0
ii. Constant factor = 0.0; linear factor = 1.0; quadratic factor = 1.0
iii. Constant factor = 1.0; linear factor = 0.0; quadratic factor = 1.0
iv. None of the above

h. **[2.5]** A texture mapping function

i. Returns, for each point of the texture space, the corresponding point of the object's surface
ii. Describes the shape used to wrap the object
iii. May be based on the parametric description of the object's surface
iv. All of the above

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Practical Part **40%**

Multiple choice questions: each wrong answer deducts 1/3 of the question's value
Note: Unless otherwise specified, always assume the default camera position

Figure (a) represents a scene with one object composed by four elements (A, B, C and D); elements B and C move as illustrated by the dashed arrows. The origin of the coordinate system is illustrated as well.

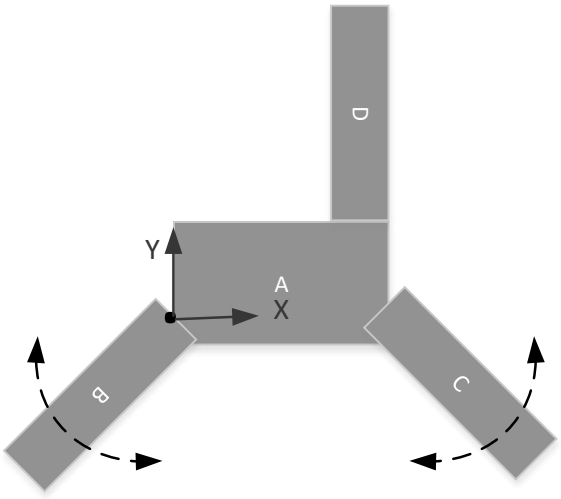

Figure (a)

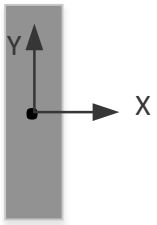

Figure (b)

a. **[2.0]** Suppose that you want to reuse an existing function called `drawSegment()` to draw each segment of the object; it draws a origin-centered rectangle as shown in Figure (b). Which constants do you need in order to set the size and the position of the elements?

_____

_____

b. **[6.0]** Write the code of a function that draws the whole object; it should receive two parameters representing the orientation of segments B and C. Reuse function `drawSegment()`.

Hint: you may create auxiliary drawing functions in order to ease the task of drawing the final scene.

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c. **[2.0]** Write the code of a GLUT keyboard callback that sets segments B and C horizontally.

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d. **[2.0]** Given that the camera is in its default position and that an orthographic projection is being used, use function `gluLookAt()` in order to define a top view of the scene.

```
gluLookAt( _____, _____, _____,
           _____, _____, _____,
           _____, _____, _____);
```

e. **[2.0]** Suppose that you want to apply a texture to scene element D and no texture at all to the remaining elements. What should you do in order to achieve that?

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f. **[2.0]** Define a material that guarantees that the object will be visible if you light the scene with a green (0.0, 100.0, 0.0) or an orange (100.0, 75.0, 0.0) diffuse light source.

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_____

g. **[2.0]** Suppose that element A represents the main body of a spaceship and that you want to model the ship's portholes with cylinders. If you want that the portholes appear to be lit from the inside of the ship, which OpenGL command should you use?

_____

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_____

h. **[2.0]** When using OpenGL's feedback mode, you are going to receive four GL_POLYGON_TOKEN elements. Given that you have configured the feedback buffer to get 3D information, what is the minimum size of the buffer?

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