Graphics Systems and Interaction

Normal Season 2019-01-21

N.o _____ Name _____

Assessment duration: 45 minutes
Value of each question: marked with brackets
Multiple choice questions: each wrong answer deducts 1/3 of the question's value

Theoretical Part **10%**

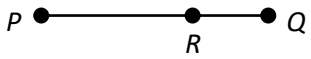
a. **[3.3]** The design of WIMP interfaces (Windows, Icons, Menus, Pointer)

   i. Should not consider the use of accelerator keys because human memory has limitations
   ii. Should be system-centered rather than user-centered because human behavior is unpredictable
   iii. Should not draw on real-world analogies
   iv. None of the above

b. **[3.3]** Perspective 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. **[3.3]** 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 twice as far from P than from Q?



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

d. **[3.3]** 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. **[3.3]** The diffuse component of Phong's illumination model

   i. Can only be defined for directional light sources
   ii. Is characteristic of materials such as shiny metal
   iii. Does not depend of the viewer's position
   iv. None of the above

f. **[3.3]** 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

Graphics Systems and Interaction

Normal Season 2019-01-21

N.o _____ Name _____

Practical Part **20%**

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

a. **[4.0]** Suppose you want to map the texture represented in Figure 1 to a rectangle so that it looks like the one shown in Figure 2. Enter the texture coordinates (*s*, *t*) corresponding to each polygon vertex.

Figure 1

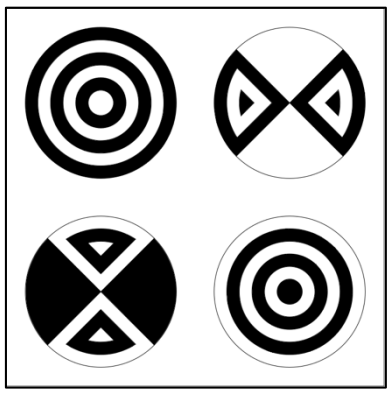
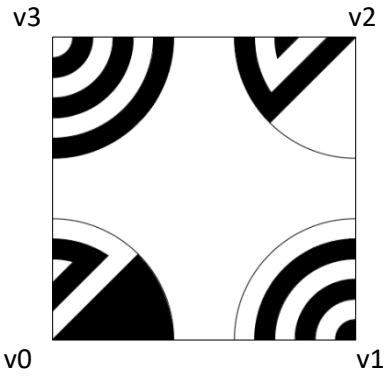


Figure 2



v0: _____, _____

v1: _____, _____

v2: _____, _____

v3: _____, _____

b. **[3.0]** Consider a sphere made of a dark gray material (0.1, 0.1, 0.1) illuminated by a single light green light source (0.75, 1, 0.75). What are the primary components (R, G, B) of the resulting color? Specify the calculations made.

R = _____

G = _____

B = _____

Graphics Systems and Interaction

Normal Season 2019-01-21

N.o _____ Name _____

c. **[4.0]** Compute the components of the unit vector normal to the quadrilateral shown in Figure 3. The visible face of the polygon is the front face, which makes an angle of 45° with the X axis.

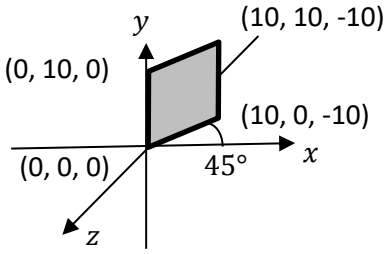


Figure 3

Normal: _____, _____, _____

d. **[4.0]** Suppose you want to simulate a camera mounted on the handlebar of a bicycle, facing forward, and rotating with the handlebar. The position of the handlebar is given by `model.x`, `model.y` and `model.z`, the direction for which the handlebar is oriented is given by `model.dir`, and the height of the camera relative to the handlebar is given by `CAMERA_HEIGHT`.

Complete the following information in order to obtain the desired camera, considering that the vertical direction is the Z axis direction (positive up).

Eye: _____, _____, _____

Center: _____, _____, _____

Up: _____, _____, _____

e. **[5.0]** Consider the object illustrated in Figure 4 and the existence of the function `box()` that draws a unit cube, aligned with the axes and centered on the origin.

Consider that:

- The dimensions of the elements are: element A (L_A, A_A e P_A); elements B and C (L_{BC}, A_{BC} e P_{BC});
- The displacement of element A along the X axis is given by D_A;
- The absolute value of the rotation angle with respect to the horizontal of elements B and C is given by R_{BC} (note that for B and C the values are symmetrical);
- Element A moves linearly over the XZ plane;
- Elements B and C rotate around the edges of element A, with angles symmetrical with respect to the horizontal;
- • The origin of the coordinate system is in the center of element A.

N.o _____ Name _____

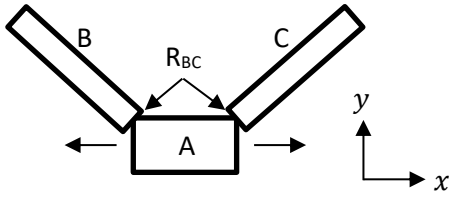


Figure 4

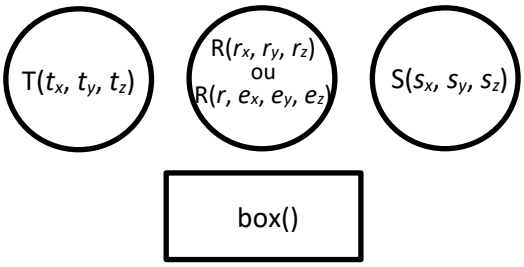


Figure 5

Draw the tree that represents the object, including the parameters of the transformations that promote the movement and the dimensions of the elements. Figure 5 shows examples of the transformations and the drawing primitive.