ShahJalal University of Science and Technology

Department of Computer Science and Engineering

3rd Year 2nd Semester Final Examination, 2015

Course Title: Computer Graphics and Image Processing

Course No: CSE – 373

Credit: 03

Time: 3:00 Hours **Full Marks: 100**

(Answer any 10 questions taking 5 questions from each group)

Group A

1. a) Indicate which locations would be chosen by Bresnsham's algorithm when scan-converting a line from pixel coordinate (2,2) to pixel coordinate (7,5). 6
   b) What are the differences between 4-connected and 8-connected approach for region filling? 4

2. a) Let R be the rectangular window whose lower-left corner is at (1,1) and upper-right corner is at (8,8). According to Cohen-Sutherland algorithm find out the region codes and identify which lines are inside/outside of the clipping window and why for the following lines:
   AB = (4,4)(5,10) EF = (2,3)(3,5) CD = (5,3)(4,-4) GH = (9,3)(13,7) 7
   b) What is the co-ordinate value of a 3-D point P(3,2,1) after rotating it 30° about the Y-axis. 3

3. What is the difference between cavalier and cabinet projection? Let a unit cube ABCDEFGH is projected onto xy plane. Find the projected coordinates using perspective projection with d=7 where,
   A= (0, 0, 0) B= (1, 0, 0) C= (1, 1, 0) D= (0, 1, 0) E= (0, 1, 1) F= (0, 0, 1) G= (1, 0, 1) H= (1, 1, 1) 2+8

4. a) A Unit Cube is projected onto the yz plane. Draw the projected image using the standard perspective transformation with i) d= 2 and ii) d=8, where d is the distance from the view plane. 6
   b) How Z-Buffer algorithm works? 4

5. a) Convert the RGB color (0.7, 0.5, 0.7) of the point S to HIS color format where the angle between S and red axis is 45°. 5
   b) Draw the model of degradation? During edge detection, what is the finding of the laplacian? 3+2

6. a) What is the relation between relative data redundancy and compression ratio? According to following table calculate the coding redundancy and compression ratio. 2+5

r_k	$p_r(r_k)$	Code 1	$l_1(r_k)$	Code 2	$l_2(r_k)$
$r_0 = 0$	0.19	000	3	11	2
$r_1 = 1/7$	0.25	001	3	01	2
$r_2 = 2/7$	0.21	010	3	10	2
$r_3 = 3/7$	0.16	011	3	001	3
$r_4 = 4/7$	0.08	100	3	0001	4
$r_5 = 5/7$	0.06	101	3	00001	5
$r_6 = 6/7$	0.03	110	3	000001	6
$r_7 = 1$	0.02	111	3	000000	6

   b) Why the filter frequencies are kept limited near the values of origin during inverse filtering? 3

7. a) Write the Prewitt and Sobel masks for horizontal and vertical edge detection. What is the difference between Prewitt and Sobel masks? Why that difference was made? 4+1+2
   b) What is the approximation of laplacian mask for diagonal neighbors? 3

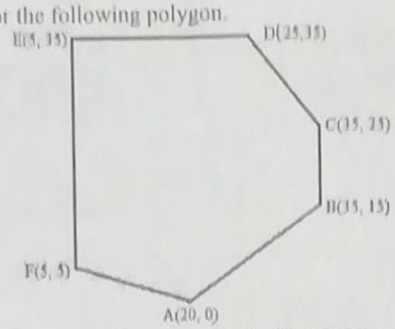
Group B

1. a) What is Lookup Table? If a pixel S is at (2,1) has the actual value 9, but approximated as 5; calculate the updated values of neighboring pixels of S according to Floyd-Steinberg top-to-bottom and right-to-left Error-Diffusion method where, a = 7/16, b = 5/16, c = 3/16, d = 1/16. 1+4

   b) What is the key-idea behind Sutherland-Hodgman algorithm? Determine whether the point P lies to the left/right of line segments AB and AC where, AB = 6I+J; AC =4I+3J; AP=6I+5J and point 'A' is at (2,3). 2+3

2. According to Scanline algorithm: 4

   a) Construct the initial edge-list for the following polygon.



   b) Find out which edges will be active on scanlines at y = 2, 7, 12, 17, 22. 2

   c) Find out the intersection points of the above scanlines with the respective active edges. 4

3. a) Find the matrix that represents rotation of an object by 45^0 about the origin. 3

   b) What are the new coordinates of the point P(1,-5) after the rotation? 3

   c) Magnify the triangle with the vertices A(2,1) B(1,1) and C(2,4) to twice its size while keeping C(2,4) fixed. 4

4. Let R be the rectangular window whose lower-left corner is at (1,1) and upper-right corner is at (8,8). Use Liang-Barsky algorithm to clip the following lines: 10

   AB = (3,-3)(5,3) EF = (2,2)(4,4) CD = (2,6)(5,10) GH = (-2,9)(4,12)

5. a) Write masks to detect i) Horizontal Line, ii) $+45^0$ Line, iii) -45^0 Line and iv) Vertical Line. 6

   b) Find histogram for the following image. 4

0	0	1	0	2	0
1	0	7	7	7	0
0	7	0	0	7	0
1	0	0	7	2	0
0	0	7	1	0	1
1	0	7	7	7	0

frequencies
f(0)= 18
f(1)= 6
f(2)= 2
f(3)=f(4)=f(5)=f(6) = 0
f(7) = 10

6. a) Define distance function. Show the pixel arrangement for D4 distance < 3 from the center point. 2+3

   b) What is the relation between spatial domain and frequency domain operation? 2

   c) Design a frequency domain filter that will force the average value of an

7. a) Write down the general form and function of different point-processin

   b) What are the basic steps for frequency domain filtering?