CompSci 373 S1 C 2009
Computer Graphics

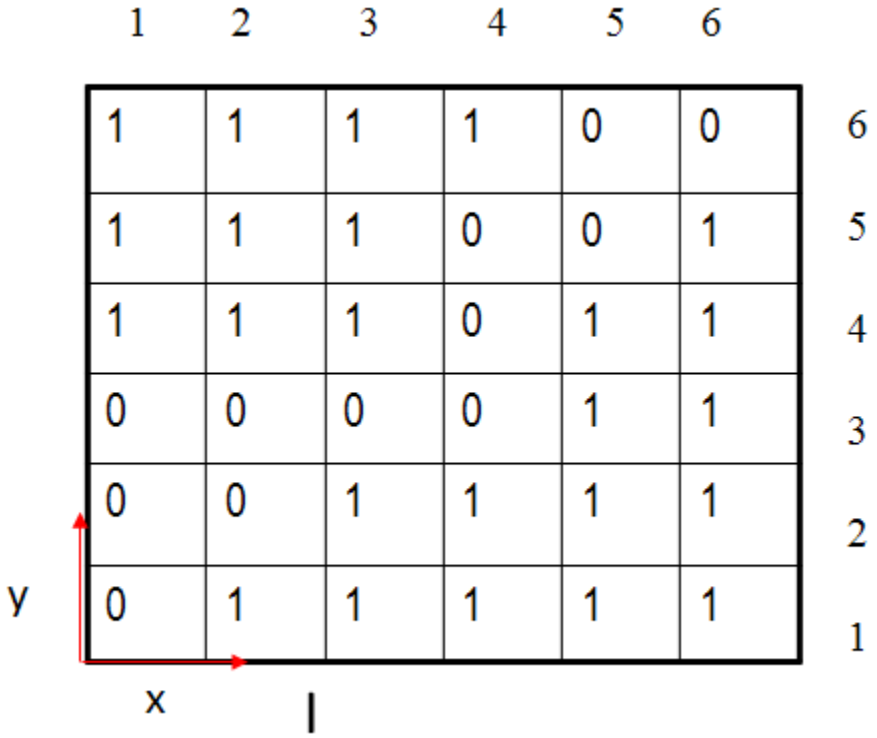
Mid Term Test – Tuesday, 28th April 2009, 3 pm – 4 pm

VERSION CODE 00000001

Instructions:

1. Attempt **ALL** questions.
2. Fill in the appropriate boxes in the answer sheet using a **pencil**. There is only one correct answer for each question.
3. If you want to change your answer **erase the previously filled in box completely** using an eraser.
4. The test is for 50 minutes.
5. This is a **closed book** test.
6. Calculators and electronic devices are **NOT** permitted.
7. **Questions total 50 Marks**. Each question is worth 2 marks.
8. This test is worth 20% of your final marks for CompSci373 S1 C

Consider the following binary image I:



Question 1

The spatial resolution of an image is

1. None of the others
2. The number of horizontal pixels times the number of vertical pixels
3. The image pixels per cm or inch horizontally and vertically
4. The length of a pixel in cm or inch
5. The width times the height in pixels

Question 2

A spectral density function specifies

1. The density of the different colors in a given wavelength
2. None of the others
3. For each wavelength, the power of that wavelength present in a given light
4. For each wavelength, the color of that wavelength in a given light
5. The density of the light waves per cm^2

Question 3

Which statement about subtractive color systems is *false*?

1. None of the others
2. (r,g,b) = (1,1,1) - (c,m,y)
3. White light is reflected or transmitted, and some wavelengths are absorbed.
4. RGB is the most popular subtractive color system.
5. Colors are mixed by subtracting appropriate amounts of colors from white.

Question 4

The dot product of $\mathbf{u} = \begin{pmatrix} 1 \\ -5 \\ 2 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 0 \\ 4 \\ -1 \end{pmatrix}$ equals

1. -22
2. 22
3. -23
4. 5
5. None of the others

Question 5

The vector product **u**×**v** where $\mathbf{u} = \begin{pmatrix} -1 \\ -1 \\ 3 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 2 \\ -1 \\ 2 \end{pmatrix}$ equals

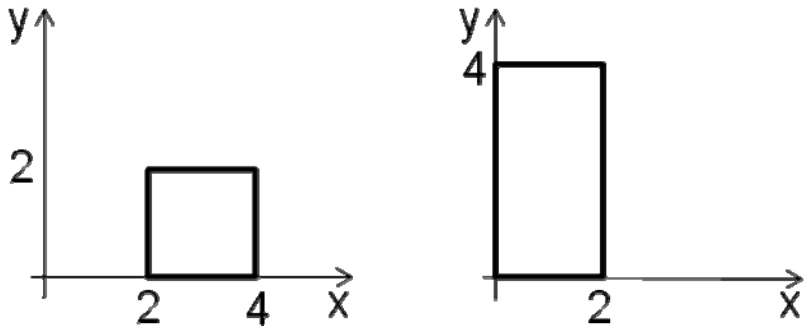
1. $\begin{pmatrix} 1 \\ 8 \\ 3 \end{pmatrix}$
2. $\begin{pmatrix} -2 \\ 1 \\ 6 \end{pmatrix}$
3. $\begin{pmatrix} -1 \\ 3 \\ 3 \end{pmatrix}$
4. $\begin{pmatrix} -1 \\ 8 \\ 4 \end{pmatrix}$
5. None of the others

Question 6

A plane with the following plane equation is given: x + 2 y – 2 z = 9.
How far is the point (5,4,2) away from the plane?

1. 9
2. 0
3. None of the others
4. 3
5. 8/3

Question 7
Which homogeneous 2D matrix transforms the figure on the left side to the figure on the right?



1. $\begin{pmatrix} -2 & 0 & -2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
2. $\begin{pmatrix} 1 & 0 & -2 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
3. $\begin{pmatrix} -2 & 0 & 2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
4. None of the others
5. $\begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

Question 8
Which statement about affine transformations is *false*?

1. The order in which affine transformations are performed matters.
2. None of the others
3. An affine transformation consists of a linear transformation and a translation.
4. After being transformed by an affine transformation, a straight line is still straight.
5. With homogeneous coordinates, affine transformations can be expressed using only a matrix multiplication.

Question 9
Which of the following statements about Phong illumination is *false*?

1. Specular reflection is largest if light is reflected directly into the eye.
2. None of the others
3. Diffuse reflection creates highlights on a surface.
4. Ambient light is scattered everywhere, even in dark corners.
5. There is generally more diffuse reflection on a rough surface than on a smooth surface.

Question 10
In Phong illumination, the specular reflection is influenced by

1. the position of the viewer and the distance to the viewer
2. the reflection direction and the light coming from the viewer
3. the position of the light source and the distance to the viewer
4. the position of the viewer and the position of the light source
5. the surface normal and the incoming ambient light

Question 11
Which of the following statements about Phong shading is *false*?

1. Phong shading interpolates the normal between the vertices of a face.
2. None of the others
3. Phong shading requires less faces to make a round surface appear smooth than Gouraud shading.
4. Phong shading is significantly slower than Gouraud shading.
5. Phong shading requires one Phong equation calculation per pixel.

Question 12
The purpose of the `intersect` function of a typical ray tracer is to

1. find the object intersection of a given ray with the smallest positive t
2. find the visible object that is closest to the camera
3. None of the others
4. find the ray that intersects the closest object
5. find the object intersection of a given ray with the smallest t

Question 13
Which statement about ray tracing is *false*?

1. For each object, a ray is traced from each light source.
2. Rays can be traced through several reflections.
3. None of the others
4. For each pixel in the image, a ray is traced from the camera.
5. For each ray, intersection tests are made with the objects in the scene.

Question 14
Which statement about SUSAN is *true*?

1. For each pixel in the image, the USAN is computed as its median value.
2. All of the others are false.
3. SUSAN is based on first and second order derivatives of the image.
4. SUSAN is the acronym for Smallest Universal Synthetic Average Normal.
5. SUSAN is a method to detect corners of an image.

Question 15
Which statement about SUSAN is *true*?

1. The USAN is always smaller than a quarter of the size of the nucleus mask.
2. A nucleus is a SUSAN corner when its USAN is brighter than the SUSAN's mask average grey level value.
3. SUSAN performance does not depend on the values of **t** (the threshold for USAN's computation) chosen.
4. All of the others are false.
5. For each pixel in the image, considering a 5 by 5 SUSAN mask, a strictly positive R value corresponds to a USAN larger than 4.

Question 16
Consider the binary image defined at the beginning of the test script and a 3 by 3 SUSAN mask. What is the USAN's area for pixel location (x,y) with x equal to 2 and y equal to 4?

1. 0
2. None of the others.
3. 3
4. 2
5. 4

Question 17
Consider the binary image defined at the beginning of the test script and a 5 by 5 SUSAN mask. What is the R value for pixel location (x,y) with x equal to 3 and y equal to 4?

1. 3
2. 0
3. None of the others
4. 4
5. 2

Question 18
Which statement is *true*?

1. All of the others are false.
2. For an N by M 8-bit grayscale image the cumulative histogram count for the grayscale value 255 is N*M
3. Two different images cannot have the same cumulative histogram.
4. For an N by M 8-bit grayscale image the cumulative histogram value for the grayscale value 255 is 255^{N*M}
5. Two different images cannot have the same histogram.

Question 19
Let us assume a greyscale image I and a linear mapping from I to J with bias **b** equal to 75 and gain **a** equal to 2. What is the greyscale value for J(2,3) if I(2,3) is equal to 50?

1. 175.
2. 75.
3. 125
4. 50
5. None of the others.

Question 20
Consider the binary image defined at the beginning of the test script. Let us define J computed as the result of applying a 5 by 5 median filter MWT to image I. What is the greyscale value for J(x,y) with x equal to 3 and y equal to 4?

1. None of the others.
2. 2
3. Undetermined.
4. 1
5. 0

Question 21
Considering the binary image defined at the beginning of the test script and circular indexing. What is the greyscale value for I(x,y) with x equal to -1 and y equal to 5?

1. None of the others.
2. Undetermined.
3. 2
4. 1
5. 0

Question 22

Considering the binary image defined at the beginning of the test script and no padding. Consider J computed as the result of applying a 11 by 11 median filter MWT to I. What is the greyscale value for J(x,y) with x equal to -1 and y equal to 2?

1. 1
2. 2
3. 0
4. Undetermined.
5. None of the others.

Question 23

Considering the binary image defined at the beginning of the test script and zero padding.

Consider J computed as the result of applying the following MWT to I: $\begin{pmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{pmatrix}$

. What is the greyscale value for J(x,y) with x equal to 2 and y equal to 3?

1. -1
2. None of the others.
3. 0
4. -2.
5. 1

Question 24

Consider the following MWT 3by 3 kernel: $\begin{pmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{pmatrix}$

What is the outcome of the above MWT at the center of a 11 by 11 area of constant greyscale values equal to 70?

1. Positive values.
2. 0
3. Negative values.
4. None of the others.
5. Always 1.

Question 25

Which statement is *true*?

1. Circular and reflected padding produce the same outcome for binary images.
2. All of the others are false
3. The median and average MWT filters never produce the same outcome.
4. A histogram displays the frequencies of appearance of grayscale values in a binary image.
5. The "negation" linear mapping transforms dark regions of an image into darker regions.

Test Solution

QuestionNumber	Answer
1	C
2	C
3	D
4	A
5	A
6	B
7	B
8	B
9	C
10	D
11	B
12	A
13	A
14	B
15	D
16	B
17	E
18	B
19	A
20	D
21	E
22	D
23	E
24	B
25	D