course, exam #, semester/year CS 184, Midterm #1, Fall 1997)

CS184, Fall 1997
Midterm #1
Professor Brian A. Barksy

Fall 1997 Foundations of Computer Graphics Professor Brian A. Barsky and Adrian Sfarti
October 9, 1997 CS184 T.A.'s: Lilian Chu, Dan Garcia and Aaron Isaksen

MIDTERM EXAM

NAME (LAST, FIRST):
CS184-:

Relax. You have 80 minutes. Remember to pace yourself. Feel free to use the back of each page for additional answer space. Note that not all questions have equal value. Do not panic.

GOOD SKILL!

(write any comments about the exam here)

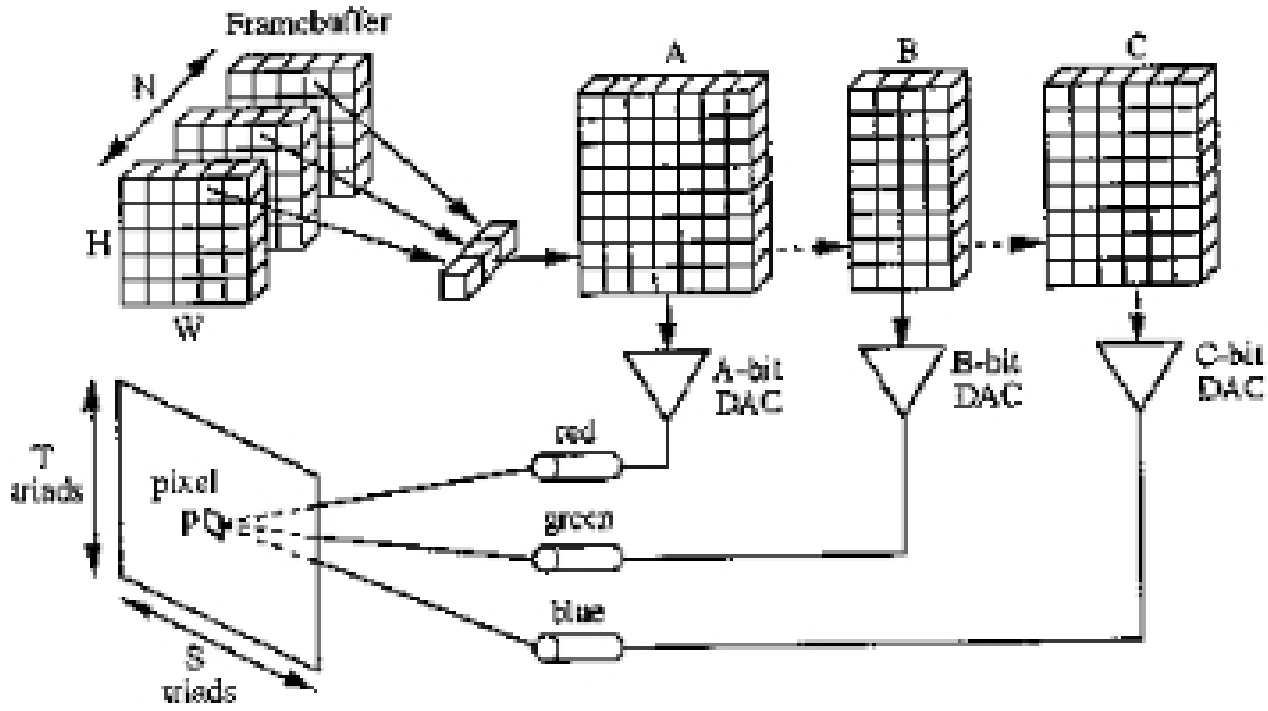
How well do you believe you did?
(Circle the appropriate picture which represents your perceived midterm rank)

:) :) :] :| :[:(X#

Question	Possible	Your Score

1	15
2	25
3	25
4	35
Total	100

Question 1: Hardware and Scan Conversion (15 points)

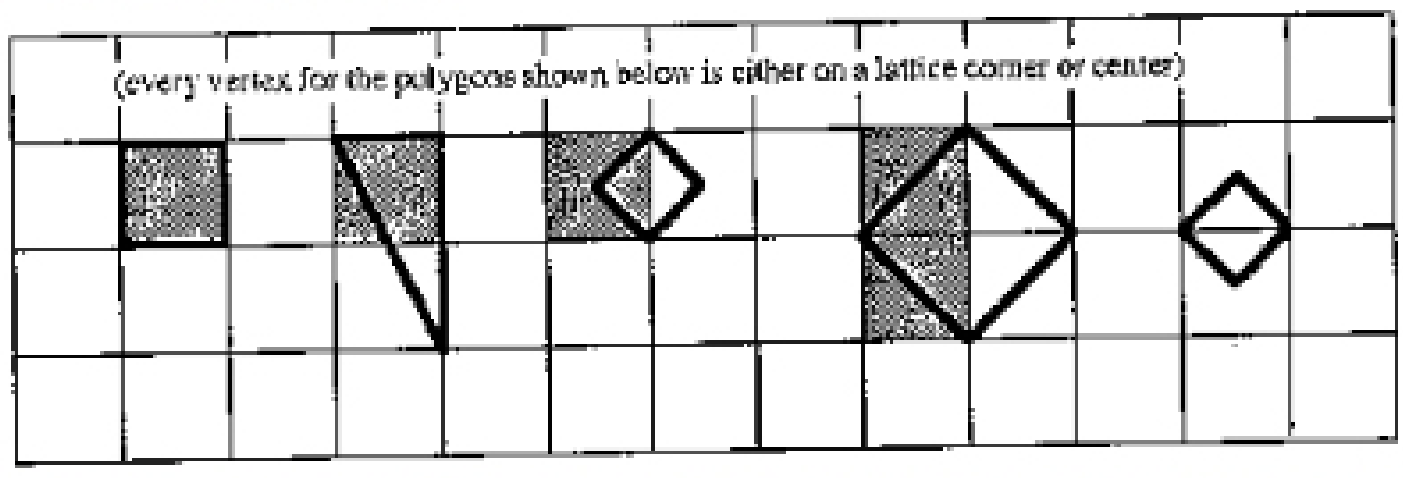


The diagram shown above shows a colormap system with a N bit deep W wide and H high framebuffer, digital-to-analog converters (DAC) for red, green and blue which are A, B and C bits wide respectively, and a screen with S triads wide and T triads high. Using the variables above (and assuming nothing about N, W, H, A, B, C, S or T - the diagram above is not to scale), **derive an expression for:**

1.1) ...the # of pixels on the screen. [1 pt]

1.2) ...the # of colors that could ever land on pixel p over time. [2 pts]

1.3) ...the # of possible colors on the screen at once. [2 pts]



1.4) Up to now, you have always been given a sample point (and two tie-breaking directions) and asked to render polygon primitives. Here we give you the polygon primitives and rendered pixels and ask you to figure out the sample point and two tie-breaking directions. **The sample point lies on the edge of the polygon.** Hint: The tie-breaking driections **do not necessarily have to be horizontal or vertical.** [10 pts]

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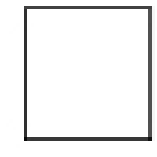
Answer 1: Hardware and Scan Conversion

1.1)

1.2)

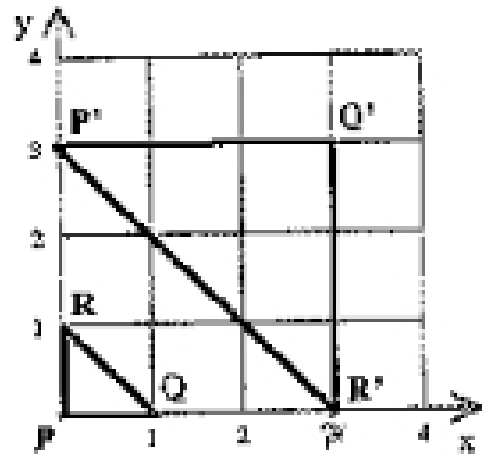
1.3)

1.4) (Indicate sample point and two tie breaking directions on the picture below.)



Question 2: Transformations (25 points)

The figure to the right shows a 2-D triangle **PQR** transformed by a transformation matrix **T** to a new position **P"Q"R"**. Pay careful attention to the fact that **T** must transform **P** to **P"**, **Q** to **Q"** and **R** to **R"**.



2.1) Using row-vector notation, show **T** as a composition of matrices **Scale(s_x, s_y)**, **Translate(t_x, t_y)**, **Rotate(theta)**, **Shear$_x$ (a)** or **Shear$_y$(b)** with appropriate arguments. [10 pts]
E.g., **T = Rotate(30^o) * Shear$_x$(5)*Translate(10,3)**

2.2) Write down the 3x3 transformation matrix **T**. Show all work. [10 pts]

2.3) Show the inverse matrix **T^{-1}** (which transforms the triangle **P"Q"R"** to **PQR**) using a composition of matrices **Scale(s_x,s_y)**, **Translate (t_x, t_y)**, **Rotate(theta)**, **Shear$_x$(a)** or **Shear$_y$ (b)** with appropriate arguments. You may find your answer to question 2.1 useful here. [5 pts]

Answer 2: Transformations

2.1) T =

2.2)

2.3) T^{-1} =

Question 3: Hierarchies and Change of Bases (25 points)