Pop Quiz 1 [10 mins]

Name:

Student ID:

1. An audio signal makes 250 cycles in its span (or has a frequency of 250Hz). How many samples do you need, at a minimum, to sample it correctly? [1]

2. If the number of bits is reduced, the quantization error -------------------------- [1]

3. Draw a 3x3 kernel that will take an image as input and output as image which has a quarter dimmed ghost to its bottom right. Make sure that the total energy is preserved. [3]

4. Let us consider a signal x(t). Consider the operation \( \frac{1}{2}(x(t)\ast\delta(t) + x(t)\ast\delta(t-1)) \). This is equivalent to [3]
   - low pass filtering of x
   - high pass filtering of x
   - band pass filtering of x

5. Calculate the convolution of the following signals. [2]

   \[ h[t] = \delta[t + 1], \quad x[t] = \delta[t - a] + \delta[t + b] \]
Pop Quiz 2 [10 mins]

Name:

Student ID:

1. [1] Laplacian pyramid provides
   - low pass filtering
   - high pass filtering
   - band pass filtering

2. [2] Consider a checkerboard (black and white squares like a chess board) image rotated 45 anti-clockwise degrees. In which direction would you find the maximum values (whites) in the frequency plot? [Mark all that apply]
   - Horizontal
   - Vertical
   - 45 degrees
   - 135 degrees

3. [2] Why are we usually only concerned about the magnitude plot in frequency domain and not the phase?

4. [1] The frequency domain response of a comb function is a
   - Comb function
   - Delta
   - Gaussian

5. [2] A box filter in spatial domain is not the ideal filter due to
   - Infinite support
   - Leakage frequency
   - Aliasing artifacts

6. [2] The low pass filter is a linear operation. Given this prove that the high pass filter is also a linear operation.
1. [3] Match following images with corresponding Fourier transform

2. [3] The Harris corner detector is invariant to which of the following transformations
   i. Scaling
   ii. Translation
   iii. Rotation
   i. first derivative is maximum
   ii. Second derivative is maximum
   iii. First derivative is zero
   iv. Second derivative is zero

4. [2] What are the four steps of Canny edge detector?
Pop Quiz 4 [10 mins]

Name:

Student ID:

1. [2] Consider a 2D square whose center is at (2,2). The transformation to be applied to achieve a scaling of the square by 2 in the X direction and 3 in the Y direction is given by
   - $T(2,2)S(3,2)T(-2,-2)$
   - $T(-2,-2)S(3,2)T(2,2)$
   - $T(2,2)S(2,3)T(-2,-2)$
   - $T(-2,-2)S(3,2)T(2,2)$

2. [1] The intrinsic parameter matrix of a camera is a
   - Lower Triangular matrix
   - Upper Triangular matrix
   - Symmetric matrix

3. [1] Consider a vector with direction $(x,y)$. Its homogeneous coordinates is given by
   - $(x, y, 1)$
   - $(x, y, 0)$
   - $(kx, ky, 0)$
   - $(kx, ky, 1)$

4. [5] Match the transformations on the left with their description on the right.

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Linear Transformation</td>
<td>Do not change the length and angles</td>
</tr>
<tr>
<td>Affine Transformation</td>
<td>Do not change the degree of the curves</td>
</tr>
<tr>
<td>Euclidean Transformation</td>
<td>Do not change the ratio of lengths and angles</td>
</tr>
<tr>
<td>Projective Transformation</td>
<td>Can change the degree of curves and surfaces</td>
</tr>
<tr>
<td>Linear Transformation</td>
<td>Can change parallel lines to intersecting lines</td>
</tr>
</tbody>
</table>

5. [1] A non-uniform scaling is applied to a sphere. The resulting 3D shape will be
   - Sphere
   - Ellipsoid
   - Paraboloid
   - Cube
Pop Quiz 5 [10 mins]

Name:

Student ID:

1. [3] What are the steps of graphic pipeline?

2. [4] What the steps of geometric transformation?

3. [3] The 3D coordinate of two point P₁ and P₂ are (2,3,2) and (4,5,4). The 2D position of these two points in the screen space are (100,100) and (100,200). What is the depth (Z) of point P₃ which has the 2D coordinate (100,120) on the screen?
Pop Quiz 6 [10 mins]

Name:

Student ID:

1. [2] When we mix blue paint with yellow paint we get green. But when we project blue light on yellow light, we get brown. How do you explain this contradiction?

2. [1+1+1=3] Consider the spectrum of a color given by C.
   - The hue of C is given by
     - The area under C
     - The weighted mean of the wavelengths weighed by the power
     - The standard deviation from the weighted mean
   - The saturation of C is given by
     - The area under C
     - The weighted mean of the wavelengths weighed by the power
     - The standard deviation from the weighted mean
   - The intensity of C is given by
     - The area under C
     - The weighted mean of the wavelengths weighed by the power
     - The standard deviation from the weighted mean

3. [2] Consider two colors with chromaticity coordinate (0.4,0.3) and (0.2, 0.5). In what proportions of intensity should they be mixed to create the color (0.3, 0.4)
   - (1/4, \(\frac{3}{4}\))
   - (1/2, \(\frac{1}{2}\))
   - (3/4, 2/5)
   - (1/3, 2/3)

4. [3] Consider a color of chromaticity coordinate (0.3, 0.5) and luminance 50. The tristimulus value of the color is given by
   - (15, 25, 10)
   - (30, 50, 20)
   - (50, 20, 30)
   - (10, 25, 15)