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 *½(x(t)*∂(t) + x(t)*∂(t-1)).* This is equivalent to [3]
   - o low pass filtering of x
   - o high pass filtering of x
   - o band pass filtering of x

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

$$h[t] = \partial[t+1], \quad x[t] = \partial[t-a] + \partial[t+b]$$

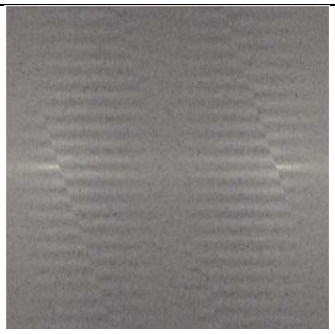
6. **[1]** Laplacian pyramid provides
   - o low pass filtering
   - o high pass filtering
   - o band pass filtering
7. **[2]** Consider a checkerboard (black and white squares like a chess board) image rotated 45 anti-clockwise degrees. In which direction would you find the maximum values (whites) in the frequency plot? [Mark all that apply]
   - o Horizontal
   - o Vertical
   - o 45 degrees
   - o 135 degrees
8. **[2]** Why are we usually only concerned about the magnitude plot in frequency domain and not the phase?

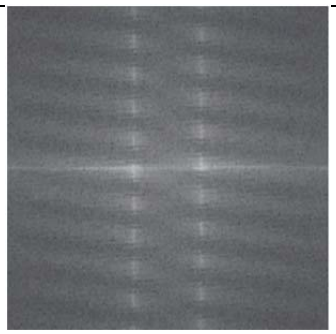
9. **[1]** The frequency domain response of a comb function is a
    - Comb function
    - Delta
    - Gaussian

10. **[2]** A box filter in spatial domain is not the ideal filter due to
    - Infinite support
    - Leakage frequency
    - Aliasing artifacts

11. **[2]** The low pass filter is a linear operation. Given this prove that the high pass filter is also a linear operation.

12. **[3]** Match following images with corresponding Fourier transform

13. [3] The Harris corner detector is invariant to which of the following transformations

i.Scaling

ii.Translation

iii.Rotation

14. [2] Which of followings indicates an edge

i. first derivative is maximum

ii. Second derivative is maximum

iii. First derivative is zero

iv. Second derivative is zero

15. [2] What are the four steps of Canny edge detector?

16. [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)

17. [1] The intrinsic parameter matrix of a camera is a

- Lower Triangular matrix
- Upper Triangular matrix
- Symmetric matrix

18. [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)

19. [5] Match the transformations on the left with their description on the right.

Non- Linear Transformation	Do not change the length and angles
Affine Transformation	Do not change the degree of the curves
Euclidian Transformation	Do not change the ratio of lengths and angles
Projective Transformation	Can change the degree of curves and surfaces
Linear Transformation	Can change parallel lines to intersecting lines

20. [1] A non-uniform scaling is applied to a sphere. The resulting 3D shape will be

- Sphere
- Ellipsoid
- Paraboloid
- Cube