



Attend all questions (4x5=20 marks)

with a
variation
of 10

1. Grandma pulled out an old faded photograph and showed it to her grandson, who had just learned image processing in his class. She asked him if he could help restore it. The grandson noticed that some pixels appeared slightly brighter or darker than they should, likely due to age, dust, or scanning imperfections. Curious, he wanted to figure out what kind of noise was affecting the image. Thinking back to his lessons, he guessed that the variations might follow a smooth, bell-shaped curve around the true pixel values. Focusing on one particular spot where the true brightness is around 120, he observed a pixel value of 130. He wants to estimate the likelihood of seeing this value, and reason numerically how this probability would change if occasionally the photo had stronger imperfections like scratches or stains.
2. Students were provided with a blurred and noisy image that was degraded during transmission. The students are asked to design a technique that can recover the original image as clearly as possible using information about both the blur and the noise. They must explain how their method decides the right balance between removing noise and keeping image details and describe what visual effects would appear if the noise or blur level were estimated incorrectly.
3. During an experiment on image compression, an engineer observes that an uncompressed grayscale image of size 1024×1024 pixels (each pixel stored with 8 bits) is reduced to a compressed file of 262,144 bytes after applying a certain algorithm. The students are asked to calculate the compression ratio and the percentage reduction in storage size achieved by the system. They must then interpret whether such a ratio suggests a lossless or lossy compression approach and discuss what visual or data artifacts might appear if the same compression method were pushed to achieve twice this ratio.
4. A professor gives students an activity using the LZW compression algorithm. The students are asked to find or create an input where the encoder produces a code that the decoder has not yet added to its dictionary, causing a temporary "code not found" situation. They must then write the output code sequence and show how the decoder finally rebuilds the correct text. The students should explain why this happens and how LZW is still able to decode the data correctly even when such a case occurs.