

**EBU5303 Multimedia Fundamentals**

# Worksheet 3: JPEG, MPEG

## Question 1. Do you remember?

1. Which phenomenon of human vision is exploited in chroma sub-sampling?
2. In JPEG compression, what is the role of the DCT?
3. What type of MPEG frame makes no prediction?
4. Define motion estimation and motion compensation.

## Question 2. Do you understand?

1. Explain why JPEG is said to be lossy.
2. Explain the use of quantisation tables in the JPEG compression process
3. Explain what is encoded in a P frame.
4. Explain the Block Matching Algorithm (BMA) for motion estimation.

## Question 3. Can you apply your knowledge?

1. With the 4:2:2 chroma-subsampling scheme, a 16 x 16 macroblock yields: four 8 x 8 blocks of Y values; two 8 x 8 block of Cb values; and two 8 x 8 block of Cr values. What is the compression rate achieved?
2. Consider that the matrix shown in the first table is a matrix of DCT coefficients. Apply quantisation to this matrix, using the quantisation matrix shown in the second table.

To achieve more compression, what would you change to the quantisation matrix?

|  |  |  |  |
| --- | --- | --- | --- |
| 1300 | 1000 | 400 | 200 |
| 800 | 600 | 100 | 50 |
| 400 | 80 | 15 | 10 |
| 40 | 20 | 4 | 2 |

|  |  |  |  |
| --- | --- | --- | --- |
| 5 | 20 | 50 | 99 |
| 20 | 50 | 99 | 99 |
| 50 | 80 | 99 | 99 |
| 99 | 99 | 99 | 99 |

1. Suppose an MPEG encoder uses this 12-frame GOP sequence IBBBPBBBPBBB. Draw the frame dependencies.
2. Draw the transmission order of this GOP.

## Question 4. Can you analyse and/or evaluate?

1. For image decompression, what information do you think should be stored in the JPEG image file header?
2. JPEG is lossy, but some JPEG images look exactly like the original image after decompression. How is this possible?
3. How could the block-matching algorithm for motion estimation be made faster?
4. How could a “clever” MPEG encoder adapt the GOP size with the video content?

## Question 5. Can you create?

1. Write a simple MATLAB program that can read an image file and split it into 8x8 blocks.
2. Devise a simple pseudo algorithm to perform JPEG decoding (decompression).
3. Write a simple MATLAB program that can read a video file and perform motion estimation with the first two frames of the video (the program can stop once it has found one matching macroblock).
4. Devise a simple pseudo code to perform MPEG decoding (decompression).