University of Toronto Faculty of Applied Science and Engineering

## MIDTERM EXAMINATION 2 ECE462H1S, Multimedia Systems

March 22, 2024, 10:10– 11:00 am Instructor: D. Hatzinakos

## Instructions:

- 1. The exam counts for 15% of the overall mark.
- 2. Please answer all questions. Do not show only final answers. You should demonstrate how the answer has been obtained by including intermediate results and explanations wherever needed.
- 3. Write your name and student number on top of all submitted pages.
- 4. All answers must be written in the provided examination paper

1. Assume that in an EZW based compression of a 4x4 image f(x,y), the decoder receives the following information.

• We use the following codes

Zerotree root	zr	10
Significant positive	sp	11
Significant negative	sn	00

Isolated zero iz 01

What is the reconstructed 1 -pass wavelet transform? (4 points)

- 2. Continuing question 1, find the reconstructed image corresponding to the reconstructed 1pass wavelet transform. (2 points)
- 3. In an MPEG2 scheme the following quantization operations are considered for the sequence X: 16.3, 21.4, 10.3, 2.8, 20.6, 6.3, 8.1, -7.5
  - a) Xq=round (X/8). At the decoder the signal is reconstructed and the reconstruction error is calculated
- b) A scalable SNR process where initially Xq=round(X/4) followed by an additional quantization of the reconstruction error with scale factor 2 followed by another reconstruction.

Which one of (a) or (b) produces less overall reconstruction error? (4 points)

4. A video sequence is coded by using the following GOP (group of pictures) display order: I1, P2, P3, P4, I5, P6, P7, P8.
What is the transmitted frame order? (1 point) What is the transmitted frame order when the display frame order is

I1, B2, B3, B4, P5, B6, B7, P8? (1 point)

- 5. In a 8 level 2-D Wavelet transform NxN what is the size (resolution) of the largest subband and what is the size (resolution) of the smallest sub-band? What is the overall number of sub-bands? (2 points)
- 6. What is asymmetrical coding in video encoding? Name one such encoder or video standard. Compared to a symmetric coding standard which one is expected to produce a higher quality reconstructed video? (1 point)