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 1 level HT, $T_0 = 16$, $1.5 T_0 = 24$ $\frac{T_0}{4} = 4$

D_0: 11 01 01 01 11 01 01 0111 01 01 01 01 01 01 01

sp i² i² i² sp i² i² i² sp i² i²̇ i² i² i²̇ i² i²

$S_0 = 000$

first pass

Correction

$W = $

   ✓

②

$F = A^H W A$ where $A = \frac{1}{n}\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 \end{bmatrix}$

... result $= \begin{bmatrix} 30 & 70 & 0 & 0 \\ 10 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

③

a) Original

sample x: 16.3 21.4 10.3 2.8 20.6 6.3 8.1 -7.5

round $\left(\frac{x}{8}\right)$ 2 3 1 0 3 1 1 -1

reconstruction 16 24 8 0 24 8 8 -8

error 0.3 -2.6 2.3 2.8 -3.4 -1.7 0.1 0.5 →

b) Now

round $\left(\frac{x}{4}\right)$ 4 5 2 1 5 2 2 -2
                16 20 8 4 20 8 8 -8

~~error~~

error 0.3 1.4 2.3 1.2 0.6 1.7 0.1 0.5

~~total~~

round $\left(\frac{error}{2}\right)$ 0 1 1 1 0 1 0 0

reconstruction 0 2 2 2 0 2 0 0

total reconstruction 16 22 10 2 20 6 8 -8

error 0.3 0.6 0.3 0.8 0.6 0.3 0.1 0.5 →

b) gives less quantization error
_____

④ P_1 P_2 P_3 P_4 I_5 P_6 P_7 P_8 ⟍ same as P_i depends on I_j 's only

transmission
order I_1 P_2 P_3 P_4 I_5 P_6 P_7 P_8

I_1 B_2 B_3 B_4 P_5 B_6 B_7 P_8

transmission
order I_1 P_5 B_4 B_3 B_2 P_8 B_7 B_6

⑤ smallest resolution. $\dfrac{N}{2^8} \times \dfrac{N}{2^8}$

highest resolution $\dfrac{N}{2} \times \dfrac{N}{2}$

total ~~sub bands~~ sub bands : $8 \times 3 + 1 = 25$

⑥ Asymmetrical coding occurs when the decoder and encoder
are basically different. The decoder is well specified
but the encoder can be implemented with additional
features and higher sophistication as needed.

Asymmetric coders provide in general better image quality