

Midterm Examination: CMPUT 414 B1 Anup Basu
Closed book, 60 mins., 50 marks

1. (a) [7] Consider coding the following 8-bit (0 to 255 gray level value) image. Derive the variable length Huffman codes for this image.

10 10 10 10 10
10 10 10 10 10
20 20 20 20 20
20 20 20 20 20
40 40 40 40 40
40 40 40 40 40
40 40 40 40 40
50 50 50 50 60

- (b) [3] What is the average code length using Huffman codes for the above?

2. (a) [3] Consider the following sequence of numbers. Propose a 1D first order predictive coder that does a "good" job in reducing redundancy in the data. Justify your choice of predictor.

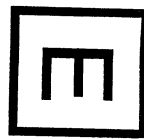
10 10 10 10 10 10 10 10 10 10 10 10 10 10 250 10 10 10 10 10 10 10 10 10 10 10 10 10

- (b) [4] Given that 8-bits/symbol is used to represent the original data & 4-bits are used to store run lengths, how many bits are needed to code the data using the prediction in part (a) followed by run length encoding?

- (c) [3] What is the problem in using an "optimal" first-order linear predictor (as discussed in class) instead of the simple predictor in part (a)? (Do not try to derive the optimal predictor.)

3. What type of JPEG mode will you use for the following applications? Justify your answer in a few sentences.

- (a) [2] A radiologist needs to store and transmit X-ray images that may be used to diagnose small tumors.
(b) [2] You need to store JPEG images in a multimedia CD.
(c) [2] You want to put a JPEG image for viewing over the Internet. A client should see a blurred image to start with, and the should get clearer with time.
(d) [2] A client on the Internet would like to view a small (thumbnail) version of a JPEG image followed by a larger version of the image if (s)he wishes.



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4. Consider transmitting video data over a network. For simplicity, assume the following:
- ◆ An INTRA encoded macroblock needs around 200 bytes of storage.
 - ◆ An INTER encoded macroblock needs around 50 bytes of storage.
 - ◆ We are transmitting 240 x 320 resolution images.
 - ◆ The bandwidth between the client and the server is 4 Mbits/sec.
- (a) [5] If MPEG standards are followed, and every 6th frame is an I-frame and the other frames are P-frames, what is the minimum bitrate for transmitting 30 frames every second?
- (b) [2] What is the minimum requirement for Intra-encoding of macroblocks following H.263 standards?
- (c) [5] What is the minimum bitrate for transmitting 30 frames/sec following the minimum H.263 requirements in part (b)?
- (d) [2] Can the given network handle the MPEG video bitrate in part (a)? Can the given network handle the H.263 bitrate in part (c)?
- (e) [2] If the video bitrate is higher than the network capacity what modifications in the video stream do you suggest so that bitrate can be reduced?
- (f) [3] Given a MPEG video stream similar to part (a) & a H.263 video stream similar to part (c), if the bitrates of both streams is very close to the network capacity which stream will you choose to lower jitter? Justify your answer in a few sentences.
- (g) [3] Consider the problem of retrieving segments of video matching corresponding text or audio segments from a Multimedia Data Storage. As a multimedia designer will you use H.263 or MPEG, where the video is coded in a style similar to parts (a) & (c). Explain the rationale behind your choice in a few sentences. (Note: Bandwidth limitations and jitter are not of any concern for this question.)