



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF
SCIENCE IN COMPUTER SCIENCE

SCO 405: COMPRESSION TECHNIQUES

DATE: 30/5/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Questions ONE and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Explain any three reasons why data compression is needed in real life (7 marks)
- b) Define entropy calculate the average entropy for the message: HELLO WORLD!
(10 marks)
- c) Briefly describe Huffman coding and then encode the message below using Huffman coding “senselessness” (10 marks)
- d) Briefly explain how each type of frame, in the group of pictures, achieves some form of video compression. (5 marks)

QUESTION TWO (20 MARKS)

- a) Explain the arithmetic coding algorithm (6 marks)
- b) Given the following Differential Pulse Code Modulated (DPCM) Sequence reconstruct the original signal. $+4 + 2 + 3 - 2 + 3 - 1 + 1 + 1$ (3 marks)
- c) Briefly explain why a bidirectional B-frame improves video compression rates and state the drawbacks of B-frames (5 marks)
- d) Discuss growing trends in data compression in computer science (6 marks)

QUESTION THREE (20 MARKS)

- a) Encode the message AAAABBBBAABBBBBBCCCCCCCCDABCBAABBBBCCD using
- i Pattern Substitution (3 marks)
 - ii Run Length Encoding (fixed and variable) (4 marks)
 - iii Shano-Fannon Encoding (3 marks)
- b) Briefly outline, with the aid of suitable diagrams, the JPEG/MPEG I-Frame compression pipeline and list the constituent compression algorithms employed at each stage in the pipeline. (10 marks)

QUESTION FOUR (20 MARKS)

- a) Transmit the data {250, 251, 251, 252, 253, 253, 254, 255} through a bandwidth of 16 bits using lossy compression. (7 marks)
- b) Describe LZW coding algorithm (4 marks)
- c) Given that Alphabet: $X = \{A, B, C\}$ and Message: ABABCBABAB, encode the message using the LZW algorithm (3 marks)
- d) Briefly explain the basic approach of entropy coding algorithms and give two examples of entropy coding algorithms (6 marks)

QUESTION FIVE (20 MARKS)

- a) Briefly explain how the Huffman coding algorithm can be adapted for the streaming of live token streams. (6 marks)
- b) Briefly outline the MPEG-4 structured audio standard. (8 marks)
- c) Using the table below, encode the message below using arithmetic coding. (6 marks)

Symbol, x	Probability N(x)
A	0.4
B	0.3
C	0.2
D	0.1