



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE
IN COMPUTER SCIENCE

SCO 308: DESIGN AND ANALYSIS OF ALGORITHMS

DATE: 2/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question One and Any Other Two

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the following terminologies or phrases: (5 marks)
- Algorithm
 - Priori analysis
 - Complexity of an algorithm
 - Asymptotic analysis of an algorithm
 - Quick Sort
- b) Differentiate between Big (Oh) Notation and Omega notation in the context of algorithm performance analysis. Support your answers with graphs and equations (5 marks)
- c) You have been presented with \$1, 7, and 10 coins and asked to solve the following problems using greedy algorithm design approach. Explain your workings:
- Count \$18, explaining why your algorithm works or fails (4 marks)
 - Count \$15, explaining why your algorithm works or fails (6 marks)

QUESTION TWO (20 MARKS)

- a) Using your knowledge and experience in designing and analyzing sorting algorithms, answer the following questions:
- i) Identify and explain the algorithm design technique that merge sort uses (2 marks)
 - ii) State the worst case time complexity of this sorting technique, explaining how it affects the popularity or effectiveness of the sorting technique (2 marks)
 - iii) Your assignment is to demonstrate to a group of young programmers how you would go about sorting the following array using merge sort technique. Take note to illustrate your workings at each stage. (6 marks)



- b) Discuss dynamic programming as a technique for designing algorithms noting to highlight any three problems that can be solved (or have been solved) using this technique. (10 marks)

QUESTION THREE (20 MARKS)

- a) Write short notes about divide-and-conquer technique for designing computer algorithms. Support your answers using a diagram. (10 marks)
- b) Design an algorithm for adding two numbers and displaying the result. (6 marks)
- c) Suppose X is an algorithm and n is the size of input data, identify and explain the two factors that decide the efficiency of X (4 marks)

QUESTION FOUR (20 MARKS)

- a) Explain any four factors that affect algorithm analysis (8 marks)
- b) You are to design an efficient recursive algorithm that will return values in a binary search tree that bracket a specified key. Specifically, given a binary search tree A containing n elements, a key k and a constant integer b, your algorithm will return two sets S⁻ and S⁺. S⁻ is to contain the largest b elements of A that are smaller than or equal to k. If there are fewer than b elements smaller than or equal to k, S⁻ should contain all of them. S⁺ is defined similarly, but will contain the smallest b elements that are strictly larger than k. Provide pseudocode for your algorithm. Clearly specify the precondition and post-condition in your pseudocode. Clearly indicate the base case and how it is handled. How many 'friends' are you using? Are they being given a smaller input? (12 marks)

QUESTION FIVE (20 MARKS)

- a) Not all procedures can be called an algorithm. An algorithm should have some specific characteristics. Explain any such five characteristics (10 marks)
- b) With the help of a diagram, describe the Big (Oh) asymptotic notation. Ensure you include the necessary mathematical expressions used (10 marks)