南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Course Name： **Data Structures and Algorithm Analysis B (code: CS203B)**

Dept.： **Department of Computer Science and Engineering**

Exam Duration： **120 minuites** **Exam Paper Setter：** **HE Mingxin**

Question No.	1	2	3	4	5	6	7	8	9	10
Score	15	8	12	9	10	10	12	11	18	

This exam paper contains **9** questions (35 sub-questions) and the score is **105** in total (in which extra 5 points as bonus). (Please hand in your exam paper, answer sheet, and your scrap paper to the proctor when the exam ends.)

Question 1 **Matching** (15×1 point = 15 points)

Fill in each blank represented with a number with parentheses in the sentences using the best LETTER(s) representing the corresponding term(s) from the following alternatives listed below. Or answer a **T** or **F** according to the correctness of each complete statement. Each of which could be re-used and could be the answer for more than one of **(1)~(15)**:

Alternative Answers:

A. algorithm C. cutoff D. degree F. false G. in-degree H. heap
I. input J. insert L. linked lists M. modifications N. map
O. output P. out-degree Q. queue R. in-place S. stack T. true
U. f(n) = Θ(g(n)) V. f(n) = O(g(n)) W. f(n) = Ω(g(n))

An algorithm is a sequence of unambiguous instructions for solving a computation problem, i.e., for obtaining a required **(1)** for any legitimate **(2)** in a finite amount of time.

A data structure is a way to store and organize data in order to facilitate access and **(3)**.

A FIFO data structure is called as a **(4)** and a LIFO data structure is called as a **(5)**.

A sorting algorithm is **(6)** if it uses $\leqslant$ c log N extra memory.

To prevent too many recursive call for tiny sized array slice in mergesort or quicksort, in practice to enhance efficiency normally use **(7)** to insertion sort when the length of slice is small enough.

In a directed graph, **(8)** of a vertex is the number of edges directed to the vertex and **(9)** of a vertex is the number of edges started from the vertex.

Question 2 On Tidle Notation (4×2 points = 8 points)

By definition, $f(N) \sim g(N)$ means $\lim_{N \to \infty} \frac{f(N)}{g(N)} = 1$

In our text, we use tidle notation f(N) ~ g(N) instead of Big-O notation to estimate running time (or memory) as a function of input size N. The key idea is to keep the leading term in g(N) with coefficient and to ignore lower order terms in f(N). When N is large, those lower order terms are negligible; when N is small, we don't care.

Please write down **the corresponding ~g(N) for the following f(N)**. (*You do not need to explain your answer.)*

(16) f(N) = N (4 N log N – log N)+ 3 $(N^2)^{4/3}$

(17) f(N) = 2 N^2 log N^2 + 3 N $\log^2$ N

(18) f(N) = 5 $N^{1/2}$ + $\log^3$ N

(19) f(N) = (N (4 N + 5 + 3 N^2))^2

Reference Answer:

(16) ~ 3 $N^{8/3}$

(17) ~ 4 N^2 log N

(18) ~ 5 $N^{1/2}$

(19) ~ 9 N^6