Data Structure Homework 1

Note

- A file should be .pdf or .doc.
- A file's name starts with your student ID followed by an underscore then your name. ex: 410521213_陳姿吟.pdf
- Questions must be answered in English.
- A scanned version is acceptable as long as it is legible; however, it's not recommended.

Submission and Deadline

- NDHU e-learning
- Monday, 14th October 2019 before midnight

Questions

1. There is a sparse matrix below. Please write or draw the data structure stores in a two-dimensional array clearly.

0 1 0 0 0
-5 0 0 1 3
0 0 0 0 9
0 0 11 0 0

2. Consider a sparse 6 x 6 matrix represented by a following array. Please calculate rowCount and rowStart arrays needed for matrix transposition. What will be the index of element with value 3 after the transposition?

index	row	column	value
0	0	1	81
1	0	3	10
2	2	1	3
3	3	2	104
4	4	4	52
5	5	3	67

Index	0	1	2	3	4	5
rowSize						
rowStart						

3. Suppose that the first element of array a is a[0][0] or a[0][0][0] and its address is 200. Assume that each int element requires 4 bytes and each float element requires 8 bytes. Please give the address of the indicated element in each of the following cases.
   (a) int a[7][10]; row-major order; find element a[4][5].
   (b) float a[7][10]; column-major order; find element a[4][5].
   (c) int a[5][4][6]; column-major order; find element a[3][1][4].
   (d) float a[5][4][6]; row-major order; find element a[3][1][4].

4. The function $f(x) = 3n^2+10n \log n+1000n+4 \log n+9999$ belongs in which of the following complexity categories:
   (a) θ(lg n)
   (b) θ(n2log n)
   (c) θ(n)
   (d) θ(n lg n)
   (e) θ(n2)
   (f) None of these

5. Rank the following functions by asymptotic growth rate in non-decreasing order:
   $(\frac{3}{2})^n,\ 2^{64}-1,\ n^3,\ 0.0001n^2,\ 10000n,\ \log n^2,\ 2^{\log n},\ n\log n,\ n2^n,\ 2^{1000},\ n,\ n^2\log n,$
   $2^n,\ \log n,\ n^{100},\ 4^n,\ \log n^3,\ n^n,\ n^3\log n$