

quiz1a

- (a) Obtain an addressing formula for the element $a[i_1][i_2] \dots [i_n]$ in an array declared as $a[u_1][u_2] \dots [u_n]$. Assume a column-major representation of the array with one word per element and α the address of $a[0][0] \dots [0]$.
- (b) What the formula is when array is represented by row-major order?
- (c) A is a 2-dimensional array with size $m \times n$. The location of $A[3][2]$ is 1110 and $A[2][3]$ is 1115. Assume that each element occupies one address, then what is the location of $A[1][4]$?

quiz1b

- (a) What are the definitions of asymptotic notations, O (big oh) and Θ (Theta), which are used for time complexity comparison?
- (b) Please derive the corresponding time complexity (Big-Oh) for each of the following two program segments.

(1) $k=0;$ for($i=0; i < N; i++$) $k++;$	(2) $k=0;$ for($i=0; i < N; i++$) for($j=1; j < i * i; j++$) if($j \% i == 0$) for($z=0; z < j; z++$) $k++;$
--	---

quiz2a

Knuth-Morris-Pratt algorithm is a fast string pattern matching algorithm. A failure function of pattern analysis is computed in advance to speed-up finding process.

$$f(j) = \begin{cases} \text{largest } k \text{ such that } k < j \text{ and } p_0 p_1 \dots p_k = p_{j-k} p_{j-k+1} \dots p_j & \text{if such a } k \geq 0 \text{ exists} \\ -1 & \text{otherwise.} \end{cases}$$

- (a) Please compute the failure function $f[]$ of the pattern **abaabaaba**.
- (b) Please describe Knuth-Morris-Pratt algorithm, int *FastFind*(String pat), if the pattern failure function $f[]$ is ready.
- (c) Demonstrate Knuth-Morris-Pratt algorithm to find the pattern in (a) step by step if the string is **ababaabbabaabaabaabbabb**

quiz2b

- (a) Write the postfix and prefix form of the following expression $(2+5)*6+40/(2+3*6)+15$
- (b) Please describe the data structure and algorithm to transfer infix expression into postfix form. You must demonstrate your algorithm by expression in question (a).
- (c) Please describe the data structure and algorithm to evaluate postfix expression. You must demonstrate your algorithm by expression in question (b).

quiz3a

The rat in a maze experiment is a classical experimental psychology. A rat is asked to navigate a maze. It is placed at a certain position (the entry position) in the maze and is asked to try to reach another position (the exit position). Positions in the maze will either be open or blocked with an obstacle. Describe the algorithm, data structures for the rat-maze problem.

quiz3b

Sparse matrix by triple <row,col,value> style is adopted for computation efficiency. (a) Show the example according right side matrix.(Generate array \mathbf{a} []).

(b) Please describe the sparse matrix addition algorithm. Time complexity of the algorithm must be $O(m+n)$ that m,n are non-zero item number is each sparse matrix.

(c) The time complexity of Fast_transpose algorithm for sparse matrix transposing is $O(\text{terms}+\text{columns})$ (hint: using row_terms and starting_pos array). Please show Fast_transpose algorithm and analysis the time complexity.