| 國立雲林科技大學 104 學年度 碩士班招生考試試題 | 系所：資工系 科目：計算機概論(1) |

1. Determine the value, *true* (1) or *false* (0), of the following Boolean expressions in C++. Please indicate if some expression produces an error

   int a = 0, b = 10;

   (a) !((((a < b) || (x < y)) && (a >= 0)) || ((b / a) > 5))   **(5%)**
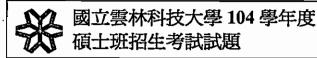
   (b) ((b / a) > 0) || (b <= 10)   **(5%)**

2. Rewrite the following loop in C++ as *for* loop. **(8%)**

   long m = 100;

   do {

      cout << 'X';

      m += 100;

   } while (m < 1000);

3. Write a C++ function *double* power(*int* x, *int* n) to calculate x^n, where n can be positive, zero, or negative (n is an integer). **(8%)**

4. Consider the following C++ codes:

   struct Node

   {   *double* data;

   Node *next;   };

   typedef Node* Pointer;

   Pointer q;

   Assume that **q** points to a node of type Node that is on a linked list and is not the last node on the list. Write C++ codes to delete the node after the node pointed to by **q**. **(8%)**

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5. What is the output of the following C++ code fragment? **(8%)**

   int ArraySize = 15;

   int *p; p = new *int* [ArraySize];

   int *a = p; int i;

   for (i = ArraySize - 1; i >= 0; i--) p[i] = i;

   a[0] = -1; a[ArraySize - 1] = -2;

   for (i = 0; i < ArraySize; i++) cout << p[i] << " "; cout << endl;

6. Write C++ codes to implement Quicksort and analyze its time complexity. **(8%)**

7. In computer science, garbage collection is a mechanism of memory management. Please describe in detail what garbage collection is. In addition, what are the advantages and disadvantages of garbage collection? **(10%)**

8. Consider a direct-mapped cache with 256 blocks and a block size of 16 bytes. To what block number does byte address 19 map? Assume that the block numbering is zero-based numbering. **(10%)**

9. What is the difference between interrupt-driven I/O versus polling I/O? (You should describe the difference as much detail as possible.) **(10%)**

10. Suppose we have a processor with a base CPI of 1.0, assuming all references hit in the primary cache, and a clock rate of 4GHz. Assume a main memory access time of 100*ns*, including all the miss handling. Suppose the miss rate per instruction at the primary cache is 2%. How much faster will the processor be if we add a secondary cache that has a 7.5*ns* access time for either a hit or a miss and is larger enough to reduce the miss rate to main memory to 0.5%? **(10%)**

11. Suppose that we can improve the floating point instruction performance of machine by a factor of 5 (the same floating point instructions run 5 times faster on this new machine). What percent of the instructions must be floating point to achieve a speedup of at least 4? **(10%)**

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A. 題目1至題目10為單選題，每題5分。(50%)

1. Which events can cause a trap (or software interrupt)?
   (A) division by zero
   (B) I/O completion
   (C) clock interrupt
   (D) event completion

2. Which are correct for computing environments?
   (A) Apple iOS is is an open-source system.
   (B) A hard real-time system guarantees that critical tasks be completed on time.
   (C) One type of cloud computing is software as a service (SaaS) that provides storage available over the Internet.
   (D) In a peer-to-peer system, the server is a bottleneck.

3. Which schedulers can be used to control the degree of multiprogramming?
   (A) job scheduler
   (B) CPU scheduler
   (C) multi-processor scheduler
   (D) disk scheduler

4. Which are correct for process states?
   (A) If a process is created, it will enter the"running" state.
   (B) If the waiting event of a process occurs, the process will enter the "running" state.
   (C) If a running process executes I/O, it will enter the "waiting" state.
   (D) If a running process encounters an interrupt, it will enter the "waiting" state.

5. Which are correct for multithreading?
   (A) A traditional process has multithreading control.
   (B) A multithreaded process comprises a register set and multiple stacks.
   (C) Linux implements the many-to-one multithreading model.
   (D) Solaris 9 supports the one-to-one multithreading model.

6. Which scheduling criteria cannot be used to compare CPU-scheduling algorithms?
   (A) waiting time
   (B) turnaround time
   (C) I/O access time
   (D) responsetinme

7. For deadlock prevention that a process requests all needed resources prior to commencement of execution, what conditions doesthe approach try to prevent?

   (A) mutual exclusion

   (B) hold and wait

   (C) no preemption

   (D) circular wait

8. Which are incorrect for pure segmentation?

   (A) Segmentation is a memory-management scheme that supports the user view of memory.

   (B) A particular advantage of segmentation is the association of protection with the segment.

   (C) An advantage of segmentation involves the sharing of code or data.

   (D) Like paging, segmentation has no external fragmentation.

9. Which are correct for page sizes?

   (A) Because each active process must have its own copy of the page table, a small page size is desirable.

   (B) To minimize internal fragmentation, we need a large page size.

   (C) A desire to minimize I/O time argues for a large page size.

   (D) With a larger page size, locality will be improved.

10. Which are correct for virtual memory?

   (A) FIFO page replacement is a stack algorithm.

   (B) The LRU strategy is the optimal page-replacement algorithm looking backward in time, rather than forward.

   (C) The accuracy of the working set depends on the selection of Δ (i.e., the working-set window). If Δ is too small, it will encompass the entire locality.

   (D) If I/O is done to or from user virtual memory, these pages do not need to be locked in memory when demand paging is used.

B. 題目11至題目13為詳答題。(50%)

  11.[Synchronization] (20%)

  (a) What are four sections in a process that tries to solve the synchronization problem? [Hint: 4 sections] (5%)

  (b) What is the general structure that consists of 4 sections for a process to solve the synchronization problem? (5%)

  (c) What are **three requirementsthat should be satisfied**for solving the synchronization problem? (10%)

12. [Memory management](20%)

    (a) What type of address does CPU reference?　(5%)

    (b) Why?　(5%)

    (c) Why needs paging for memory management?　(5%)

    (d) Describe the mechanism of paging for memory management. (5%)

13. [Cloud Computing] (10%)　//Specify the functions of each in detail, rather than translation.

    (a) What is the Virtual Machine (VM) in Cloud Computing: (3%)

    (b) Why needs a VM? (2%)

    (c) In cloud computing, what is the first step function has to be included? Why?　(2%)

    (d) List at least 2 main functions provided by Cloud Computing. (3%)

1. (12%) Given $A^{-1} = \begin{bmatrix} 1 & -1 & 3 \\ 2 & 0 & 5 \\ -1 & 1 & 0 \end{bmatrix}$ (a) Find A. (b) Solve the system of equations $Ax = \begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$ (c)

Find a matrix B such that $AB = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ (d) Find a matrix C such that

$CA = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 1 & 1 \end{bmatrix}$

2. (4%) Compute the determinant of $A = \begin{bmatrix} 1 & -1 & 2 & 0 & 2 \\ 0 & 1 & 0 & 4 & 1 \\ 1 & 1 & 5 & 0 & 0 \\ 0 & 0 & 0 & 3 & -1 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$

3. (8%) (a) Find the characteristic polynomial, eigenvalues and eigenvectors for
$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ (b) Find the eigenvalues for A^T

4. (6%) Diagonalize the matrix $A = \begin{bmatrix} 2 & 0 & 0 \\ 1 & 2 & -1 \\ 1 & 3 & -2 \end{bmatrix}$ as the form $P^{-1}AP = D$ where D is a

diagonal matrix and P is an invertible matrix.

5. (10%) Find the least square approximating line for the data points $\{(1, 1), (3, 2), (4, 3), (6, 4)\}$ and use it to predict the point (5, y). Show the pair (5, y).

6. (10%) (a) Find the matrix that maps R2→R2 such that $\begin{bmatrix} 1 \\ 2 \end{bmatrix} \to \begin{bmatrix} 7 \\ 3 \end{bmatrix}$ and $\begin{bmatrix} -1 \\ 1 \end{bmatrix} \to \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ (b)

Proof that the transformation is linear.

7. (5%) If there is an inverse function of $f(x)$, find the inverse of the function $f(x) = ax - b$ from R to R, where a and b are integers.

8. (5%) Compute $C(n,0) - C(n,1) + C(n,2) - C(n,3) + ... + (-1)^n C(n,n) = ?$

9. (6%) A box contains twelve white, eight black, and ten blue balls.
   a) How many ways can you choose a sample of three white, two black, and six blue balls?
   b) What is the probability that a sample of three balls contains one of each color?

10. (5%) Draw the graph corresponding to the relation $\geq$ on the set $\{2, 3, 4, 5\}$

11. (9%) Show that any two consecutive terms in the Fibonacci Sequence are relatively prime.

12. (10%) In how many ways can a 100-foot wall be built from 6-foot and 10-foot sections, ignoring the order of the sections?

13. (10%) Prove that for all $n \in Z^{+}, n > 3 \Rightarrow 2^{n} < n!$.