國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所、電子系
科目：計算機概論

1. (10 points) Design a Turing machine that performs the addition of two nonnegative unary numbers that are on the tape separated by a single blank cell. You need to show the machine's instructions and state diagram. (Note: the nonnegative unary numbers 0,1, 2 and 3 are represented as 1, 11,111and 1111, respectively.)

2. (10 points) Write a complete C++ program to read in two integers and then write out the greatest common divider of those two numbers. (Hint: the input and output instructions of C++ are ***cin*** and ***cout***, respectively)

3. (10 points) A tennis tournament has n players, where n > 1. A single match involves two players. The winner of a match will play the winner of a match in the next round, where losers are eliminated from the tournament. The two players who have won all previous rounds play the final game, and the winner wins the tournament. What is the total number of matches needed to determine the winner? Write a C++ function, named ***int NumberOfMatches (int numberOfPlyers),*** to perform this task.

4. (10 points) The following four requests could come into an operating system as it is running on a computer system: (a) the clock inside the computer has just "ticked," and we need to update the seconds counter. (b) the program running on processor ***k*** is trying to perform an illegal operation code. (c) Someone pulled the plug on the power supply, and the system will run out of power in the 50*msec.* (d) the disk has just read the character that passed under the read/write head, and it wants to store it in memory before the next one arrives. In what order should the operating system handle these requests?

5. (10 points) Insert the keys, in the order given as follows, to build them into an AVL tree: ***AZBYCX***. (Note: show the procedure step-by-step.)

6. (10 points) Construct a context-free grammar over $\{a, b\}$ whose language contains precisely the strings with the same number of a's and b's.

7. (15 points) State the Church-Turing Thesis. Why is this called a thesis, instead of a theorem? Give two reasons to support the Church-Turing Thesis.

8. (10 points) What is a perceptron? Describe its algorithm. What problems can a perceptron solve? What problems cannot be solved by a perceptron? Suggest a modification to the perceptron so that the originally unsolved problems become solvable.

9. (15 point) The bin-packing problem follows: Given an unlimited number of bins of volume 1 unit, and given n objects, all of volume between 0.0 and 1.0, find the minimum number of bins needed to store the n objects. Describe a brute-force algorithm, an approximation algorithm and an optimal algorithm to solve the problem. Give an example to demonstrate your algorithms. What are their time complexities?

國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所
科目：離散數學

1. Convert the binary number 11110.1101 to base 10 and also convert 19.2 to binary. (6%)
2. Given $A = \{1, 2, 3\}$ and $B = \{u, v\}$, how many different functions are there from A to B? From B to A? (4%)
3. Find the inverse of the function $f(x) = 3x - 1$ from $\mathbf{R}$ to $\mathbf{R}$. (5%)
4. Define the relation R on $\mathbf{Z}$ to be $a\,R\,b$ if $a - b$ is prime. Is R reflexive? Symmetric? Transitive? Explain why! (5%)
5. Verify that the expression $(p \Rightarrow q) \Leftrightarrow (\neg p \vee q)$ is a tautology. (5%)
6. If Archimedes was tall, then Euclid was short. Euclid was not short unless Pythagoras was fat. Pythagoras was fat only if he ate too much. Pythagoras did not eat too much. Therefore, Archimedes was not tall. Is the above logic inference valid? Show your inference step! (5%)
7. Draw the Karnaugh maps for the following function and find the corresponding minimal expression. (8%)

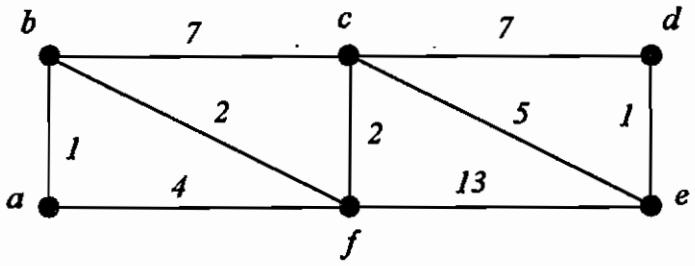
x	y	z	$f(x, y, z)$
T	T	T	F
T	T	F	T
T	F	T	F
T	F	F	F
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	T

8. Compute $C(n,0) - C(n,1) + C(n,2) - C(n,3) + \ldots + (-1)^n C(n,n) = ?$ (5%)
9. The population of Olympia is approximately 18, 273. Show that at least two people in Olympia have the same initials. (Note that some people do not have middle names.) (5%)
10. A box contains twelve white, eight black, and ten blue balls. (8%)
    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?
11. Draw the graph corresponding to the relation ≥ on the set {2, 3, 4, 5} (5%)
12. Using the Dijkstra's Shortest-Path Algorithm, find the shortest path from a to d in the

國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所
科目：離散數學

following figure. (8%)



13. Show that any two consecutive terms in the Fibonacci Sequence are relatively prime. (8%)

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

15. Let $\Sigma = \{a, b, c, d, e\}$. (a) What is $|\Sigma^2|$? $|\Sigma^3|$? (b) How many strings in Σ^* have length at most 5? (6%)

16. Please minimize the finite state machine shown below. (7%)

	Next State		Output	
	0	1	0	1
S_1	S_4	S_3	0	0
S_2	S_5	S_2	1	0
S_3	S_2	S_4	0	0
S_4	S_5	S_3	0	0
S_5	S_2	S_5	1	0
S_6	S_1	S_6	1	0

國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所、電子系
科目：作業系統

題目1至題目10爲多選題，每題5分。每題需全部答對才給分，答錯倒扣1.5分。

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

2. Which are correct for DMA?
   (A) While the DMA controller is performing the data transfer, the CPU waits for its completion.
   (B) It is used for high-speed I/O devices.
   (C) Only one interrupt is generated per block.
   (D) The DMA controller steals memory cycles from the CPU.

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

4. Which are correct for indirect communication (or mailboxes)?
   (A) A process that wants to commnucation must explicitly name the recipient or sender of the communication.
   (B) A link is associated with exactly two processes.
   (C) A number of different links may exist between each pair of communicating processes.
   (D) A link is established between a pair of processes only if both members of the pair have a shared mailbox.

5. Which are correct for multithreading?
   (A) A traditional process has a single thread of control.
   (B) A thread comprises a thread ID, a program counter, a register set, a stack, and its data section.
   (C) Windows 2000 implements the one-to-one multithreading model.
   (D) Solaris 2 supports the many-to-many multithreading model.

國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所、電子系
科目：作業系統

6. Which scheduling criteria can be used to compare CPU-scheduling algorithms?
   (A) waiting time
   (B) turnaround time
   (C) I/O access time
   (D) response tinme

7. For deadlock prevention that a process requests all needed resources prior to commencement of execution, what conditions does the approach try to prevent?
   (A) mutual exclusion
   (B) hold and wait
   (C) no preemption
   (D) circular wait

8. In a paging system using TLB, if it takes 20 ns to search TLB, and 100 ns to access memory, then under what hit ratios the effective memory-access time will be less than or equal to 140 ns?
   (A) 0.9
   (B) 0.85
   (C) 0.8
   (D) 0.75

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 small 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 disk space allocations such as contiguous, linked, and indexed?
   (A) One problem with contiguous allocation is determining how much space is needed for a file.
   (B) There is no external fragmentation with linked allocation.
   (C) It is inefficient to support a direct-access capability for linked allocation files.
   (D) Indexed allocation supports direct access, without suffering from external fragmentation.

國立雲林科技大學
九十二學年度碩士班入學招生考試試題

系所：資工所、電子系
科目：作業系統

11. Compare and contrast the two terms regarding name mapping in a distributed file system: location transparency and location independence. (10%)

12. FIFO page replacement is relatively easy to implement, and has low overhead. But FIFO can easily replace a heavy used page. Design a simple modification to FIFO that is also easy to implement, has low overhead, and prevents a heavily used page from being replaced. (15%)

13. What is "address binding"? List three "binding time". (10%)

14. The following code is a shared-memory solution to the bounded-buffer problem. The producer and consumer processes share the following variables:

```
Var n;
Type item=...;
Var buffer: array [0..n-1] of item;
    in, out: 0..n-1; /* in and out are initialized to the value 0*/
```

The code allows at most n-1 items in the buffer at the same time. Modify the code to allow all the buffers to be utilized fully. (15%)

PRODUCER process:

```
repeat
  ...
  produce an item in nextp
  ...
  while in+1 mod n = out do no-op;
  buffer[in]:=nextp;
  in:=in+1 mod n;
until false;
```

CONSUMER process:

```
repeat
    while in = out do no-op;
    nextc:=buffer[out];
    out: = out+1 mod n;
    ...
    consume the item in nextc
    ...
until false;
```