

**HWA CHONG INSTITUTION
C2 PRELIMINARY EXAMINATION 2009**

COMPUTING

Higher 2

23 September 2009

Paper 2 (9754 / 02)

0815 -- 1045 hrs

Answer ALL questions.

Begin EACH QUESTION on a FRESH SHEET of paper.

The maximum mark for this paper is 100.

1. All computers consist of components (processor, memory, controllers, video) connected together with a **bus**.
 - (a) Explain what is meant by the following terms, giving a brief indication as to the function of each bus system.
 - (i) Address Bus [2]
 - (ii) Data Bus [2]
 - (iii) Control Bus [2]
 - (b) The definition of the processor as "Program in Execution" is used in the study of operating systems. Distinguish the different between process and program? [4]
 - (c) A user has not got a sufficient amount of RAM to run a particular program. How can disk caching help with the problem, and what extra problem could this cause? [2]
 - (d) Why must all program source code be converted into machine code to run on the computer? [2]
2. An operating system is an interface between hardware and user.
 - (a) List **FOUR** services provided by an operating system. Explain how each provides convenience to the users. Explain also in which cases it would be impossible for user-level programs to provide these services. [8]
 - (b) What are the **THREE** major activities of an operating system in regard to memory management? [3]
 - (c)
 - (i) Explain what is meant by a Direct Memory Access(DMA). Explain how it works [4]
 - (ii) Give an example of a device that supports DMA? [2]

3. A bank has set up a Wide Area Network (WAN) so that branches can pass data to each other. Customers can view up-to-date statements and transfer money between their accounts using the Internet. The data have to be protected from accidental loss and malicious damage.
 - (a) Distinguish between serial and parallel transmission in a network. Give example to show the two transmissions. [4]
 - (b) Describe **THREE** security aspects of a network which must be addressed. [3]
 - (c) Noise on the line can distort a data signal and result in bits being incorrectly received. Name and describe a technique to detect such errors. [2]
 - (d) Explain, giving a suitable example in each case, what is meant by the terms accidental loss and malicious damage. [3]
 - (e) RAID systems are common on file servers on a LAN.
 - (i) Explain what is meant by RAID? [1]
 - (ii) How does it work? [2]
 - (iii) Why is it used so extensively? [2]

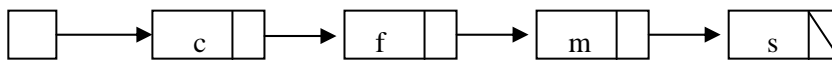
4. There are several guidelines you can use to determine which file organization and access mode to use in an application.
 - (a) The HC Company stores details of its customers in a random access file using a hashing algorithm.
 - (i) Explain the term random access file, giving an example of an application which would need to use a random access file. [2]
 - (ii) State an advantage of a random access file over a sequential file. [1]
 - (iii) Outline the function of a hashing algorithm. [1]
 - (iv) What data element is used as an input to the hashing algorithm? [1]
 - (v) A simple hashing algorithm used by HC is one which converts a six digit input number as follows:

“The six digits are added together, then the result is divided by 29, and the remainder is used as the output from the algorithm. Calculate the output, if the input is 931796.”

 [1]
 - (b) Explain the use of data encryption for the storage and transmission of data. [2]
 - (c) Explain when and why a transaction log is used. [2]
 - (d) Outline the need for recovery procedures in a computer system. [2]

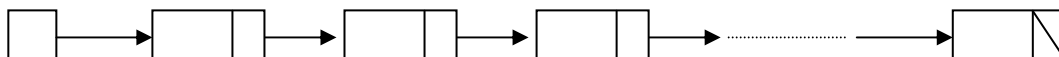
5. UPS prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, UPS relies on a company-wide information system. Shipped items are the heart of the UPS product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the UPS system at a single retail center. Retail centers are characterized by their type, uniqueID, and address. Shipped items make their way to their destination via one or more standard UPS transportation events (i.e., flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g, flight, truck), and a deliveryRoute.
- Create an Entity Relationship diagram that captures this information about the UPS system. Be certain to indicate identifiers (underline primary key) and cardinality constraints. [10]
 - Convert the ER diagram into a relational database schema. Be certain to indicate primary keys and referential integrity constraints (For referential integrity constraints, draw arrows from the foreign key terminating on the primary key it refers to) [8]
 - Explain what is meant by the terms data redundancy and data inconsistency in a database. [2]
6. Data are to be kept in order of a key in a linked list such as that shown.

Head



There is also a free space list.

Free



Using pseudocode, write an algorithm which will add a new element to the list. You may assume that all the keys are unique.

[9]

7. (a) There are many methods of sorting a set of records into ascending order of key. What factors would you consider in deciding which of these methods is the most suitable for a particular application? [3]
- (b) A list of N numbers is to be stored in locations 1 to N of an array in ascending order, by means of an insertion sort as follows. As the numbers are entered, the first is stored in location 1. Then, before each succeeding number is inserted, as many as necessary of those already stored are moved to the next location to leave space in the correct position for the next number.
- The numbers 13, 11, 24, 12, 20 are entered using this method so that they occupy the locations 1 to 5 in ascending order. Show the contents of the locations immediately **after** each number is inserted (that is, on 5 occasions in all). [2]
- (c) Using pseudocode, or another suitable method, write a detailed algorithm for the process described in (b) above, adding comments to show your method clearly. [6]

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