

八十六學年度 資訊 系(所) 組碩士班研究生入學考試
 科目 計算機系統 科號 0803 共 4 頁第 1 頁 *請在試卷【答案卷】內作答

- 1) Suppose the following instructions are available to you.
- | | |
|-----------------|--|
| AND R1, R2, #N | register $R1$ gets the logical AND of the contents of $R2$ with the value N (expressed in hexadecimal) |
| OR R1, R2, #N | register $R1$ gets the logical OR of the contents of $R2$ with the value N |
| ROTL R1, R2, #N | the content of $R2$ is circularly shifted left N bits and the result is written into $R1$ |
| BEQZ R1, R2, #N | jump to $[PC] + N$ to execute if the content of $R1$ is zero, where PC is the program counter, N is a signed integer |

Suppose each instruction has 32 bits, where the op code occupies 8 bits. Suppose further that the processor has 32 registers.

- (a) Consider the branch instruction. What is the range of the distances between the branch target and the branch instruction? Explain how to use benchmark programs to help determine whether this range is enough for most cases. [5%]
- (b) Using only these instructions, show how to set and clear exactly bits 1, 6, and 14 of a register R , where the least significant bit is the 0th bit. [4%]
- (c) Do the same as above, but suppose now the architecture is defined to have 64 registers. [4%]
- 2) Consider a computer which executes on the average 500 K instructions per second and has a bus bandwidth of 5 MB/sec.
- (a) If each instruction requires on average 4 bytes of information for operands and the instruction itself, what I/O bandwidth is available for DMA I/O? [3%]
- (b) Suppose the CPU performs the I/O itself and each byte of I/O requires two instructions. Suppose further that on average 10 K bytes of data are transferred per second. What I/O bandwidth is used by CPU? [3%]

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- 3) In the implementation of a demand-paged virtual-memory system, 0.2% of the memory references will result in a page fault. The access time of main memory is 200 ns, the time to copy a page to or from disk is 20 ms, and the time to run the page-replacement algorithm is 1 ms. Estimate the effective cycle time of the main memory. State clearly any assumptions you make in doing calculations [6%]
- 4) If the pipeline is deeper, the performance is better. Why not just increase the pipeline stages to gain more performance? [7%]
- 5) Some RISC architectures have instructions like "shift-one-and-add" or "shift-two-and-add". What do you think of these instructions? [6%]
- 6) Can the cache and the TLB be accessed in parallel? Explain your answer. [5%]
- 7) Design the fastest 32-bit adder using 4-bit adders and 2 to-1 multiplexers as building blocks. Assume that the worst case delay is 4 ns for a 4-bit adder and 0.5 ns for a multiplexer. [7%]
- 8) (a) Name 5 performance criteria that have been suggested for comparing CPU-scheduling algorithms. [5%]
(b) Concisely define each of these criteria. [5%]
(c) State the design goal of scheduling algorithms in terms of each of these criteria [5%]

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9) (a) Use the following page reference trace to describe the concept of locality [2%]

Ref. No. 1 2 3 4 5 6 7 6 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Page No. 2 6 1 5 7 7 7 5 1 6 2 3 4 1 2 3 4 4 4 3 4 3 4 4 4 1 3 2 3

- (b) Assume the working set is defined in terms of a 10 reference window. What are the working sets after References 10 and 26? [2%]
- (c) Describe how a timer interrupt can be used to estimate the size of the working set? [2%]
- (d) What is thrashing? [2%]
- (e) Describe a memory scheduling policy to prevent thrashing based on the working-set model [2%]

Circle the correct answers

10) Which of the following is not normally contained in the directory entry of a file? [4%]

- (a) Creation date.
- (b) Access control list.
- (c) A count of the number of free blocks in the disk.
- (d) Filename and extension.

11) The protection domain of a process is usually modeled as a matrix and named as **access matrix**. The information in each entry of the matrix is: [4%]

- (a) Domain.
- (b) Objects.
- (c) Operations.

12) In the ISO reference model, the term *interface* refers to [4%]

- (a) the software dialogue between layers on a host.
- (b) the electrical connection between machines.
- (c) the dialogue at communication subnet boundary.
- (d) the transport protocol

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- 13) A coordinator plays an important role in a distributed environment. The common features used in the *bully* algorithm and *ring* algorithm to elect a coordinator are : [5%]
- (a) timeout
 - (b) program counter
 - (c) process' priority value
 - (d) process's I/O information
- 14) A major distinction between *tightly-coupled* systems and *loosely-coupled* systems is that process synchronization: [4%]
- (a) Is simplified in a loosely-coupled system since all processors in the system can access a shared global memory.
 - (b) Is simplified in a loosely-coupled system since a single operating system must control all processors in the system.
 - (c) Is more difficult in a loosely-coupled system since there is only minimal message traffic between processors
 - (d) Is more difficult in a loosely-coupled system since there is typically no shared memory or clocks.
- 15) Audit files or journals may be used for which of the following purposes? [4%]
- (a) as backup for recovering lost or data damage.
 - (b) as an historical record of file accesses for security protection
 - (c) as a catalog of on-line user files.
 - (d) as an index for improving the performance of file systems.