

九十二學年度 通訊工程研究所 (所) 乙 組碩士班研究生招生考試

科目 計算機系統 科號 3102 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. (10 points) A program runs in 10 seconds on computer A, which has a 100 MHz clock. We are trying to help a computer designer build a machine, B, that will run this program in 6 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of the CPU design, causing machine B to require 1.2 times as many clock cycles as machine A for this program. What clock rate should design for machine B?
2. (10 points) Use Booth's algorithm to compute $2_{\text{ten}} \times -3_{\text{ten}}$.
3. (20 points) Given the bit pattern 1000 1111 1110 1111 1100 0000 0000 0000. What does it represent, assuming that it is
 - (a) a two's complement integer?
 - (b) an unsigned integer?
 - (c) a single precision floating-point number?
 - (d) a MIPS instruction?
4. (10 points) Suppose you want to perform two sums: one is a sum of two scalar variables and one is a matrix sum of a pair of two-dimensional arrays, size 1000 by 1000. What speedup do you get with 1000 processors?
5. (6%) In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems.
 - a. What are two such problems?
 - b. Can we ensure the same degree of security in a time-shared machine as we have in a dedicated machine? Explain your answer.
6. (6%) What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other?
7. (5%) Consider a system consisting of nine resources of the same type that are shared by four processes, each of which needs at most three resources. Is the system deadlock-free? Justify your answer.
8. (9%) Consider the following page reference string:

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, or seven frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each.
 - LRU replacement
 - FIFO replacement
 - Optimal replacement

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9. (9%) Describe three circumstances under which blocking I/O should be used. Describe three circumstances under which nonblocking I/O should be used. Why not just implement nonblocking I/O and have processes busy-wait until their device is ready?
10. (9%) Explain how do the *network speed*, the *number of stations*, and the *cable length* affect the performance of CSMA/CD.
11. (6%) Consider the protocol layers of the TCP/IP model. In the following figure, exactly one Protocol Data Unit (PDU) in layer N is encapsulated in a PDU at layer (N-1). It is also possible to break one N-level PDU into multiple (N-1)-level PDUs (segmentation) or to group multiple N-level PDUs into one (N-1)-level PDU (blocking).
 - a. In the case of segmentation, is it necessary that each (N-1)-level segment contain a copy of the N-level header? Justify your answer.
 - b. In the case of blocking, is it necessary that each N-level PDU retain its own header, or can the data be consolidated into a single N-level PDU with a single N-level header? Justify your answer.

