

考試科目	計算機概論	系所別	資訊科學系碩士在職專班	考試時間	2 月 5 日(日) 第 2 節
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You can write down you answers in either Chinese or English.

1. (20%) True or False

- (a) The power consumption of a CPU is proportional to the clock rate.
- (b) The page table resides in the cache and memory at the same time.
- (c) Increasing the cache size resulting in decreasing capacity misses and reducing cache access time.
- (d) The IEEE 754 single precision floating point representation of “-35.75” is “11000010000011110000000000000000”.
- (e) The worst time complexity of Mergesort is $O(n^2)$
- (f) Heap memory, aka “dynamic” memory, is used to save local variables in a function.
- (g) The regular expression x^* denotes the set of all strings of one or more x 's.
- (h) Both NAND and XOR are functionally complete.
- (i) SRAM is used for cache memory, which is a lower-density device in terms of transistors than DRAM.
- (j) It is necessary to have a stack when implementing a recursive function.

2. (20%) Multiple Choice Question

(a) About TLB and cache, choose all the correct statements:

- (1) It is possible to have a TLB hit and a cache hit, followed by a page miss.
- (2) It is possible to have a TLB hit and a cache miss, followed by a page hit.
- (3) It is possible to have a TLB miss and a cache miss, followed by a page hit.
- (4) It is possible to have a TLB miss and a cache hit, followed by a page miss.

(b) Please choose the correct asymptotic relationship(s).

- (1) n^k is $O(c^k)$, as $k \geq 1$, and $c > 1$.
- (2) $\log_2 n$ is $\Omega(\log_8 n)$
- (3) $\log_2 n^{\log_2 51}$ is $\Omega(\log_2 51^{\log_2 n})$
- (4) $\log_2 n^{\log_2 51}$ is $O(\log_2 51^{\log_2 n})$

(c) Please choose the correct statement(s).

- (1) If A and B are two mutually exclusive events with $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$. Then $P(\bar{A} \cap \bar{B}) = \frac{5}{12}$.
- (2) A can solve 90% of the questions in an exam while B can only solve 70%. The probability that at least one of them can solve a question randomly picked from the exam at least 0.95.
- (3) A bag has 5 red balls and 5 black balls. Assume that you draw a ball from the bag and throw it away without knowing what color it is. Now, the bag has only 9 balls. The probability that you draw a ball again and get a red ball is $\frac{1}{2}$.

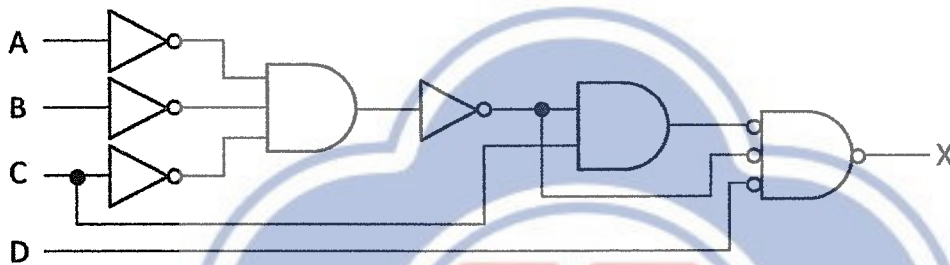
(4) If A and B are independent events, then A and B are mutually exclusive.

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4. (20%) What is Artificial intelligence (AI)? Please name three applications that use AI and explain what we can do with them.

5. (15%) Logic design.

(a) (5%) Please simplify the logic circuit below. You need to give a Boolean function using the four variables, A, B, C, and D.



(b) (10%) Given a Boolean function, $\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D}$, please draw a Karnaugh map to simplify it.

6. (15%) Please solve the recurrence relation $T(n) = 2T\left(\frac{n}{2}\right) + n \log n$. (You need to write down how you develop the solution instead of only giving the answer)

備 註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。
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