

微積分	系別	資訊科學系	考試時間	七月 星期
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1. Find the limits: 15%

(1) $\lim_{x \rightarrow 0} \frac{x^2 \sin \frac{1}{x}}{\tan x}$ (2) $\lim_{x \rightarrow 1^+} \frac{\int_1^x \sin t^2 dt}{x-1}$ (3)

$$\lim_{n \rightarrow \infty} \frac{1^k + 2^k + \dots + n^k}{n^{k+1}}$$

2. Test the series $\sum_{n=1}^{\infty} a_n$ for convergence or divergence. 15%

(1) $a_n = (-1)^n \frac{\ln n}{n}$ (2) $a_n = (-1)^n \frac{\sqrt{n}}{1+n^2}$

(3) $a_n = \frac{\cos(n\pi/6)}{n\sqrt{n}}$

3. For what values of x does the series converge? 10%

(1) $\sum_{n=1}^{\infty} \frac{(-1)^n (x-1)^n}{\sqrt{n}}$ (2) $\sum \frac{2^n (x-3)^n}{\sqrt{n+3}}$

4. Find the sum of $\sum_{n=1}^{\infty} \frac{1}{n(n+3)}$ and $\sum_{n=0}^{\infty} \frac{(-1)^n (\pi)^{2n+1}}{4^{2n+1} (2n+1)!}$. 15%

5. Use at least two distinct methods to evaluate $\ln 1.2$ correct to five decimal places. 15%

6. (1) Find the derivative of $g(x) = \int_{\tan x}^{x^2} \frac{dt}{\sqrt{2+t^4}}$. 5%

(2) Find the interval on which the curve $y = \int_0^x \frac{dt}{1+t+t^2}$ is concave upward. 5%

7. Show that $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \sqrt{x^2 + y^2 + z^2} e^{-(x^2+y^2+z^2)} dx dy dz = 2\pi$. (The improper triple integral is defined as the limit of a triple integral over a solid sphere as the radius of the sphere increases indefinitely.) 10%

8. Find an equation of the plane that passes through the point (1,2,3) and cuts off the smallest volume in the first octant (第一象限). 10%

日	計算機概論	系別	資訊科學系	考試時間	月	日	上
					星期		下

Transfer Exam for Introduction to Computer Science

注意：回答不限中英文

1. [25 points] Consider an 8-bit number with the following bit pattern:

10101110₂

- What is the decimal number if the bit pattern is in excess-128 notation?
 - What is the decimal number if the bit pattern is in 2's complement notation?
 - What is this number if the bit pattern represents a floating number of the following format: SEBEMMMM (S: sign, E: exponent, M: mantissa). The sign is 0 for positive and 1 for negative, exponent is stored in excess-4 notation, and the implied binary point is to the left of the mantissa.
 - What are the maximal and minimal positive numbers that can be represented by this format?
 - Write a function in the C programming language to print the bit pattern (higher order bits on the left) of an 8-bit character. This function should take a character as its argument and print the bit pattern of this character to the standard output.
2. [10 points] Give three examples of secondary storage devices and explain why we need secondary storage in addition to primary storage in a computer.
3. [5 points] Give reasons why the block sizes on a file system should be neither very small nor very large?
4. [10 points] A virtual memory system has a page size of 4096 words, eight virtual pages, and four physical pages. It adopts a LRU page replacement policy. Suppose that the machine starts to execute a program. The page table is initially empty, and physical pages are assigned sequentially for initial accesses. What are the physical addresses for virtual addresses: 5041₁₆ and 1002₁₆ after the program references the following sequence of virtual addresses in hexadecimal notation?
- 602B₁₆ 6029₁₆ 1000₁₆ 4079₁₆ fff₁₆ 6030₁₆ 5040₁₆ ffe₁₆ 1001₁₆
5. [10 points] Briefly describe the positions of the following network protocols in the OSI 7-layer reference model?
- Ethernet (CSMA/CD protocol)
 - TCP
 - IP
 - HTTP
 - Token-Ring

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6. [10 points] There exist pitfalls to avoid when using macros as functions in the C programming language. For example, all of the following three versions of macros are supposed to compute the square of x . Please give THREE examples (expressions) to illustrate that the macros may fail to compute correct results if we treat macros as functions. The *first* example should only fail in case (a), the *second* example should fail in case (a) and (b), and the *third* example will fail in all three cases.

- (a) `#define SQUARE(x) x * x`
 (b) `#define SQUARE(x) (x) * (x)`
 (c) `#define SQUARE(x) ((x) * (x))`

7. [20 points] Write (a) an *iterative* version and (b) a *recursive* version of a function called `reverse` in the C programming language to reverse a given string in-place (The reversed string is stored in the space of the original string). Assume that you are NOT allowed to dynamically allocate memory by calling `malloc` types of functions. The function prototype is given as follows.

```
void reverse(char *str);
```

8. [10 points] Write a recursive function in the C programming language to exchange the left and right children of all nodes in a binary tree. The data structure for a tree node is given as follows.

```
typedef struct _node {
    char data;
    struct _node *left;
    struct _node *right;
} node;
```