

考試科目	計算機概論	系所別	資訊管理學系二年級	考試時間	7月8日(三)第二節
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I. Multiple Choice (45%, 5 points for each)

1. While using UML to develop an object-oriented system design, the _____ diagrams can represent the basic relationships and the _____ diagrams can represent communication between objects.
- a) component; sequence
 - b) component; structure
 - c) class; sequence
 - d) class; structure
2. _____ prototype is used in early phases of design to test a number of ideas; whereas _____ prototype is slowly enhanced and constantly refined to become the final product.
- a) experimental; functional
 - b) throwaway; evolutionary
 - c) paper; mockup
 - d) revolutionary; scale
3. _____ initiates the execution of an operating system and the _____ activates the required functions associated with peripheral devices.
- a) boot loader; driver
 - b) system manager; driver
 - c) boot loader; multiprocessor
 - d) system manager; multiprocessor
4. Through the _____ learning technique, an agent can perform a task by learning a mapping between actions and observations.
- a) imitation
 - b) reinforcement
 - c) supervised
 - d) bootstrapping
5. Which of the following is *Not* the characteristics of data warehouse?
- a) subject-oriented
 - b) drill-across
 - c) time-variant
 - d) non-volatile

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6. Which of the following is *Not* true of OLAP operations in data warehouse?

- a) pivot
- b) roll
- c) slice
- d) integrate

7. Which of the following approach results in optimal time complexity for sorting a list?

- a) merge sort
- b) insertion sort
- c) bubble sort
- d) selection sort

8. Which of the following is *Not* a NoSQL database?

- a) document store
- b) key-value store
- c) row-oriented database
- d) graph database

9. which one the following is *Not* true of the comparison between model-free and model-based learning?

- a) boot loader; driver
- b) system manager; driver
- c) boot loader; multiprocessor
- d) system manager; multiprocessor

II. Answer the following questions (55%)

1. (15%, 5 points for each) fill in the blanks

- a) Virtual memory is one of the memory management techniques, where the area of the hard drive used for virtual memory is called a ____ file. When an OS spends too much time on paging, this is called ____.
- b) For the RAID configurations, ____ writes data on two drives at the same time; whereas ____ splits data, instructions, and information across multiple drives in the array.
- c) ____ consists of ROM chips or flash memory chips that store permanent instructions or information.

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2. Explain the CAP theorem in distributed systems

- (6%) definitions of the components
- (4%) explanation of the CAP theorem

3. (10%, 5 points for each) given the tables below (Prodcut_Name and Prodcut_Price), interpret the result of the SQL query:

Prodcut_Name

ProductID	Name
P01	Keyboard
P02	Mouse
P03	Speaker
P04	Cable

Prodcut_Price

ProductID	Price	Unit
P01	70	60
P02	55	50
P03	50	30
P04	65	80

```

SELECT Name
FROM Prodcut_Name
WHERE productid IN
(SELECT productid
FROM Prodcut_Price
WHERE price > 50 AND Unit > 50
)
ORDER BY Name ASC;

```

```

SELECT avg(price), count(price)
FROM Prodcut_Name a, Prodcut_Price b
WHERE a.productid = b.productid AND b.price >
(SELECT AVG(price)
FROM Prodcut_Price
);

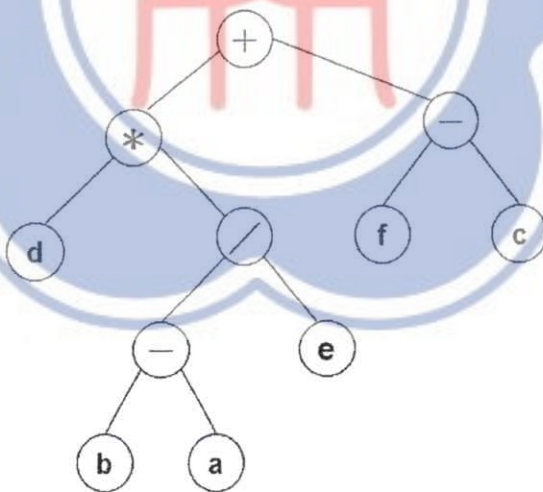
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4. (10%, 5 points for each) what is the output most likely to derive from the following code segment?

<pre> i = 1 j = 0 while i != 0: i += 1 if i > 2: j += 2 if i + j > 15: break print("i:", i, "j:", j, "\n") </pre>	<pre> def recursion(num): if(num > 0): result = num + recursion(num - 2) print(result) else: result = 0 return result print("the results are:") recursion(5) </pre>
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5. (10%, 5 points for each) Given the following expression tree, convert it to the Prefix and Postfix notations



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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Part I Problems (Multiple choice problems; 50 points; 5 points for each problem)

選擇題請在答案卡上作答，否則不予計分。

1. Which of the following statement is false?

- (a) $\frac{d}{dx} \ln(2x) = \frac{d}{dx} \ln(x)$ for $x > 0$.
- (b) $\frac{d}{dx} \csc(x) = \cot(x) \csc(x)$ for $x \in (0, \pi)$.
- (c) $\frac{d}{dx} \frac{\sin(x)}{\cos(x)} = 1 + \tan^2(x)$ for $x \in (-\pi/2, \pi/2)$.
- (d) $\frac{d}{dx} 2^x = \ln(2) \cdot 2^x$ for $x \in (-\infty, \infty)$.
- (e) $\frac{d}{dx} (x^3 + 2x + 1) = 3x^2 + 2$ for $x \in (-\infty, \infty)$.

2. Let $f(x) = 1 + x^2$ for $x \in (-\infty, \infty)$ and let $g(x) = \tan(x)$ for $x \in (-\pi/2, \pi/2)$. Which of the following statement is true?

- (a) $\frac{d}{dx} \frac{g(x)}{f(x)} = \frac{2x \tan(x)}{(1+x^2)^2}$ for $x \in (-\pi/2, \pi/2)$.
- (b) $\frac{d}{dx} (f(x) + g(x)) = 2x + \sec(x)$ for $x \in (-\pi/2, \pi/2)$.
- (c) $\frac{d}{dx} (f(x)g(x)) = \sec^2(x)(1+x^2) + 2x \tan(x)$ for $x \in (-\pi/2, \pi/2)$.
- (d) $\frac{d}{dx} f(g(x)) = 2g(x)$ for $x \in (-\pi/2, \pi/2)$.
- (e) None of the above statements is true.

3. Suppose that f is a differentiable function such that $f'(x) = -f(x)$ and $f(x) > 0$ for all $x \in (-\infty, \infty)$. Which of the following statement is false?

- (a) $f(x) = f(0)e^{-x}$ for $x \in (-\infty, \infty)$.
- (b) $f''(x) = f(x)$ for $x \in (-\infty, \infty)$.
- (c) f is strictly increasing on $(-\infty, \infty)$.
- (d) Let $g(x) = \frac{d}{dx} \ln(f(x))$ for $x \in (-\infty, \infty)$. Then g is a constant function on $(-\infty, \infty)$.
- (e) $\lim_{x \rightarrow \infty} f(x) = 0$.

4. Suppose that f is a differentiable function on $(-\infty, \infty)$ such that $f(x) = ax^2 + bx + c$ for $x \in (-1, 0)$ for some constants a , b and c and $f(x) = -0.5$ for $x < -1$. Which of the following statements is false?

- (a) $c = a - 0.5$.
- (b) If $f(0) = 0$, then $f'(0) = 2$.
- (c) If $f'(0) = 2$, then $a = 1$.
- (d) If $f(0) = 0$, then $f(x) + f(-x) = 0$ for $x \in (-1, 1)$.
- (e) f is continuous at 0.

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- 一、作答於試題上者，不予計分。
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<p>5. For $k > 0$, let $D_k = \{(x, y) : 0 \leq x \leq k\pi \text{ and } x \sin(x) \leq y \leq x\}$ and let A_k be the area of D_k. Which of the following statement is true?</p> <p>(a) $A_1 = 2\pi + \pi^2/2$. (b) $A_2 = 4\pi + 2\pi^2$. (c) $A_3 = 3\pi + 9\pi^2/2$. (d) $A_4 = 4\pi + 8\pi^2$. (e) None of the above statement is true.</p> <p>6. Let $f(x, y) = x \sin(x^2 + y) + x + y$ for $x, y \in (-\infty, \infty)$. Which of the following statement is true?</p> <p>(a) $\lim_{(x,y) \rightarrow (0,0)} \frac{f(x, y)}{x(x^2 + y)} = 1$. (b) $\int_0^a f(x, y) dy = -x \cos(x^2 + a) + x \cos(x^2) + ax + \frac{a^2}{2}$ for $a > 0$. (c) $\frac{\partial}{\partial y} f(x, y) = 2x^2 \cos(x^2 + y) + \sin(x^2 + y) + 1$. (d) The tangent plane to the surface $z = f(x, y)$ at the point $(0, 0, 0)$ is $z = 2x + y$. (e) None of the above statements is true.</p> <p>7. Suppose that f is a differentiable function on $(0, 1)$ and f is continuous on $[0, 1]$. Which of the following statement is false?</p> <p>(a) If $f(0)f(1) < 0$, then there exists a number $c \in (0, 1)$ such that $f(c) = 0$. (b) If $f'(0.1)f'(0.9) < 0$, then there exists a number $c \in (0.1, 0.9)$ such that $f'(c) = 0$. (c) If $f(0) = 0$ and $f(1) = 1$, then there exists a number $c \in (0, 1)$ such that $f'(c) = 1$. (d) If $f'' > 0$ on $(0, 1)$ and $f'(c) = 0$ for some $c \in (0, 1)$, then $f(x) \geq f(c)$ for $x \in [0, 1]$. (e) If $f(x) = f(1 - x)$ for $x \in [0, 1]$, $f(0) > 0$ and $f(0.5) = 0$, then $f''(0.5) > 0$.</p> <p>8. Define a sequence $\{a_n\}_{n=1}^{\infty}$ as follows. Let $a_1 = 1$ and $a_{n+1} = 0.5a_n + 1/n$ for $n \geq 2$. Which of the following statement is true?</p> <p>(a) $\lim_{n \rightarrow \infty} a_n = 1$. (b) $\lim_{n \rightarrow \infty} a_n = \infty$. (c) $\lim_{n \rightarrow \infty} a_n/n = 0$. (d) $\sum_{n=1}^{\infty} na_n < \infty$. (e) None of the above statements is true.</p>					
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9. Let $S = \{r : r \text{ is a positive number such that } \sum_{k=0}^{\infty} x^k/k! \text{ converges absolutely for } |x| < r\}$. Which of the following statement is true?

- (a) S is empty.
- (b) S is nonempty and $r \leq 1$ for all $r \in S$.
- (c) S is nonempty and if for some $r \in S$, a function f is defined as

$$f(x) = \sum_{k=0}^{\infty} \frac{x^k}{k!}$$

for $x \in (-r, r)$, then $f'(x) > f(x)$ for $x \in (0, r)$.

- (d) $S = (0, \infty)$.
 - (e) None of the above statements is true.
10. Let $f(x, y) = 1/(1 + x^2 + y^2)$ for $x, y \in (-\infty, \infty)$ and let $D_a = \{(x, y) : x^2 + y^2 \leq a^2\}$ for $a > 0$. Which of the following statement is true?
- (a) $\int_{D_1} f(x, y)d(x, y) = \pi \ln(2)$.
 - (b) $\int_{D_2} f(x, y)d(x, y) = \pi \ln(4)$.
 - (c) $\int_{D_3} f(x, y)d(x, y) = \pi \ln(6)$.
 - (d) $\int_{D_4} f(x, y)d(x, y) = \pi \ln(8)$.
 - (e) None of the above statements is true.

Part II Problems (50 points)

Note: For Part II Problems, SHOW YOUR WORK TO GET THE POINTS

- 11. (20 points) Use Newton's method to find the zero of $f(x) = x^2 - 3$ with $x_0 = 2$. (Perform four iterations.)
- 12. (30 points) Let $f(x)$, $F(x)$ and $h(x)$ be defined as the following:

$$f(x) = \frac{2}{\sqrt{\pi}\lambda} e^{-(x/\lambda)^2},$$

$$F(x) = \int_0^x f(t)dt,$$

$$h(x) = \frac{f(x)}{1 - F(x)}.$$

- (a) (15 points) Find $\lim_{x \rightarrow 0^+} h(x)$.
- (b) (15 points) Find $\lim_{x \rightarrow \infty} h(x)$.

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