※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

單選題（每題 2.5%）

1. *Let's define set S by*
   3 ∈ S;
   a+b ∈ S if a ∈ S and b ∈ S.
   Which of the following statements is true?
   (A) S is an empty set
   (B) S is the set of integers that are not divisible by 3
   (C) S is the set of positive integers divisible by 3
   (D) S is the set of all positive integers
   (E) None of the above
2. If you go to post office to buy postage, only post stamps of 5-dollar and 6-dollar are available. What mount of postage could be formed with 5-dollar stamps and 6-dollar stamps? Which of the following statements best describe the possible solution?
   (A) All postages that are more than 19 dollars could be formed
   (B) All postages that are more than 18 dollars could be formed
   (C) All postages that are more than 17 dollars could be formed
   (D) All postages that are more than 5 dollars could be formed
   (E) All of the above statements are false
3. A function f(n) is described as follows
   function f(n: non-negative integer)
   if n=0 then f(0):=0
   else if n =1 f(1):=1
   else f(n) := f(n-1) + f(n-2)
   Which of the following numbers belongs to f(n) ?
   (A) 4
   (B) 14
   (C) 13
   (D) 20
   (E) None of the above
4. For any n belongs to integer, n is equal or greater to zero, which of the following statements is true
   (A) $2^{2n+1}+1$ is divisible by 3
   (B) $n^3 + (n+1)^3 + (n+2)^3$ is divisible by 9
   (C) $n^7/7 + n^3/3+11n/21$ is an integer
   (D) *All of the above statements are true*
   (E) All of the above statements are false
5. Ten students enter a locker room that contains 10 lockers. The first student opens all the lockers. The second student changes the status (from closed to open or vice versa) of every other locker, starting with the second locker. The third student then changes the status of every third locker, starting at the third locker. *In general, for the k^{th} student (k is* greater than 1 and is less or equal to 10) changes the status of every k^{th} locker, starting with the k^{th} locker. After the 10^{th} student has gone through the lockers, which lockers are left open?
   (A) 8^{th} locker
   (B) 9^{th} locker
   (C) 10^{th} locker
   (D) All of the above
   (E) None of the above

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6. Assume a,b,c are all positive integers. Which of the following statements regarding gcd is false?
   (A) With gcd(a,b) = 1, If a|c and b|c are true, then ab|c is true
   (B) With gcd(a,b)=1, if a|bc is true, then a|c.
   (C) With a even and b odd, then gcd(a,b)=gcd(a/2,b)
   (D) None of the above statements are false
   (E) All of the above statements are false
7. For set A and B, which of the following statements is false?
   (A) $|A\cup B|=|A|+|B|-|A\cap B|$
   (B) $A\cap\varnothing=\varnothing$
   (C) $B\cup B=B$
   (D) $|A\cup B|\cap|B\cap A|=|A\cap B|$
   (E) None of the above is false
8. For each of the following sets, determine if 2 is an element of that set
   (A) {{2},{{2}}}
   (B) {{{2}}}
   (C) {2,{2}}
   (D) 2 is an element of all of these 3 sets
   (E) 2 is not an element of any of these 3 sets
9. Which of the following statements is false?
   (A) The union of a countable number of countable sets is countable
   (B) If A is an uncountable set and $A\subseteq B$, then B is uncountable
   (C) A subset of a countable set is also countable
   (D) The sets A and B have the same cardinality if there is one-to-one correspondence from A to B
   (E) None of the above
10. Which of the following computation mechanisms does not apply **mod** operation at all?
   (A) Public key cryptography
   (B) Private key cryptography
   (C) RSA cipher
   (D) Linear congruential generator for pseudorandom number generation
   (E) All of the above mechanisms apply mod operation
11. In how many ways can a manager divide a group of 7 workers into 2 teams? One team will wear blue jackets and the other team will wear green jackets. In each team, there is at least one worker.
   (A) 128
   (B) 126
   (C) 21
   (D) None of the above
12. How many of the four-digit integers (e.g. 1000, 1001, ...9998,9999) have four distinct digits that are increasing(e.g. 1234)?
   (A) 6
   (B) 126
   (C) 128
   (D) 1024
   (E) None of the above

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13. How many distinct terms are there in the expansion of $(a+b+c+d)^{10}$?
    (A) 256
    (B) 286
    (C) 1000
    (D) 1023
    (E) None of the above
14. How many different one-to-one functions are there from a set with five elements to set with six elements?
    (A) 720
    (B) 120
    (C) 30
    (D) 0
    (E) None of the above
15. A box contains 12 black balls and 12 white balls. The balls are taken out of the box randomly. How many balls must be taken out to be sure that there are at least 2 white balls?
    (A) 10
    (B) 12
    (C) 14
    (D) 16
    (E) None of the above
16. How many subsets with more than 2 elements does a set with 10 elements have?
    (A) 968
    (B) 90
    (C) 45
    (D) 624
    (E) None of the above
17. In a lottery game, there are 100 tickets. The tickets are numbered 1, 2, ...,100. Four different prizes are awarded. If the people holding tickets 2, 4, 8, and 16 all win prizes, how many ways are there to award the prizes?
    (A) 1024
    (B) 990
    (C) 32
    (D) 24
    (E) None of the above
18. What is the probability that a die never comes up an even number when it is rolled 5 times?
    (A) 1/5
    (B) 1/32
    (C) 3/8
    (D) 1/8
    (E) None of the above
19. How many different bit strings can be transmitted if the strong must begin with a 1 bit, must include three additional 1 bits, must include a total of twelve 0 bits, and must have at least two 0 bits following each 1 bit?
    (A) 35
    (B) C(12,4)
    (C) 7!
    (D) C(16,4)
    (E) None of the above

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20. Let event G and K be the events that a family of *n* children has children of both sexes and has at most one boy, respectively.
(A) When n=2, G and K are independent
(B) When n=4, G and K are independent
(C) When n=5, G and K are independent
(D) In all of these three cases, G and K are independent
(E) In all of these three cases, G and K are not independent

21. Which of the following statement is false?
(A) $\varnothing \subseteq \varnothing$ (B) $\varnothing \in \varnothing$ (C) $\{\varnothing, \{\varnothing\}\} \in \{\varnothing, \{\varnothing\}, \{\varnothing, \{\varnothing\}\}\}$
(D) $\{\varnothing, \{\varnothing\}\} \subset \{\varnothing, \{\varnothing\}, \{\varnothing, \{\varnothing\}\}\}$ (E) $\{a, \{b, c\}\} = \{\{c, b\}, a\}$

22. Which of the following statement is true? Note that Δ denotes the symmetric difference of two sets. I.e., $A \Delta B = (A \cup B) - (A \cap B)$.
(A) $(A \Delta B) \cap C = (A \cap C) \Delta (B \cap C)$
(B) $A - (B \cup C) = (A - B) \cup (A - C)$
(C) $A - (B \cap C) = (A - B) \cap (A - C)$
(D) $A - (B \cup C) = (A - B) - C$
(E) $(A \Delta B) \cup B \neq A \cup B$

23. Which of the following statement is always true?
(A) If relations R and S are reflexive, R – S is reflexive
(B) If relations R and S are antisymmetric, then $R \cup S$ is antisymmetric
(C) If relations R and S are symmetric, $R \cap S$ is symmetric
(D) If relations R and S are transitive, then $R \Delta S$ is transitive
(E) None of the above

24. Which of the following relation is a partial ordering on A = {a, b, c }?
(A) {(a, a), (b, b), (c, c), (a, b), (b, c), (a, c)}
(B) {(b, b), (c, c), (a, b)}
(C) {(a, a), (b, b), (c, c), (a, b), (b, a)}
(D) {(a, a), (b, b), (c, c), (a, b), (b, c) }
(E) None of the above.

25. $\begin{cases} f(0) = 2 \\ f(k) = f(k-1)^2, k > 0 \end{cases}$
Consider the above recursive function. Which of the following statement is false?
(A) f(1) = 4 (B) f(2) = 16 (C) f(3) = 256 (D) f(4) = 65536 (E) None of the above

26. $\begin{cases} a_0 = 7 \\ a_1 = 4 \\ a_k = -a_{k-1} + 6a_{k-2}, k > 1 \end{cases}$
Which of the following satisfies the above recursive function?
(A) $a_n = 2(-3)^n + 5(2)^n$
(B) $a_n = -2(3)^n + 5(2)^n$
(C) $a_n = 2(-2)^n + 5(3)^n$
(D) $a_n = -2(2)^n + 5(3)^n$
(E) None of the above

27. Which of the following does not equal $O(n^3)$?
(A) $n^4 - 3n + 5$ (B) $n^2 - 6n + 5$ (C) $(\log n)^3$ (D) $n(\log n)^2$ (E) $n^2(\log n)$

28. Which of the following grows slower than the others?
(A) $\Theta(\ln(n^{n\ln(n)}))$ (B) $\Theta(n\ln(n!))$ (C) $\Theta(n\log(n))$ (D) $\Theta(\log(n!))$ (E) $\Theta(n(\ln(n^2)))$

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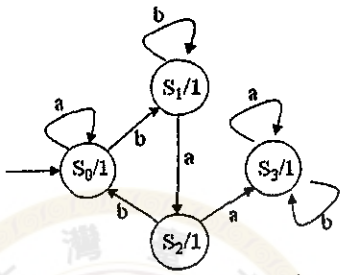
29. Which of the following codes are uniquely decipherable?
(A) 10, 110, 1110, 0101
(B) 101, 1001, 10001, 11011, 11001, 00111
(C) 101, 1101, 0101, 001, 1001, 11101, 0110, 01001
(D) 10, 110, 1110, 11110
(E) All of the above

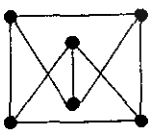
30. Which of the following is the output with input abbabab for Moore machine $M_0 = (A, \Sigma, S, s_0, F, \varnothing)$ given by the diagram below?



(A)1001110 (B) 0110001 (C) 00110001 (D) 11001110 (E) None of the above.

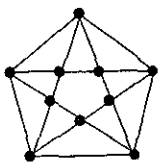
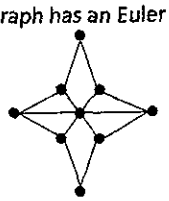
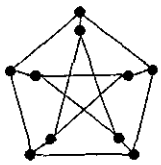
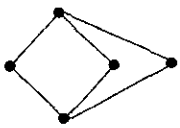
31. Which of the following is the language generated by the grammar $\Gamma = (N, T, S, P)$ defined by $N = \{S, A, B\}$, $T = \{a, b\}$ and the set of productions P given by $S \to aB$, $B \to bA$, $A \to aB$, $B \to b$?
(A) aba*b (B) abab* (C) ab(ab)* (D) a(ba)*b (E) None of the above

32. What is the following statement is false?
(A) K_5 is not a planar graph
(B) $K_{4,5}$ is not a planar graph

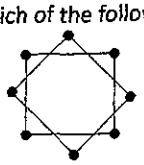
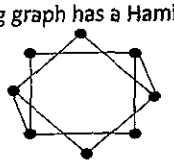
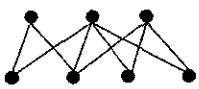
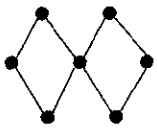

(C) is a planar graph (D)

is not a planar graph
(E) None of the above

33. Which of the following graph has an Euler cycle?


(A)

(B)

(C)

(D)
(E) None of the above

34. Which of the following graph has a Hamiltonian cycle?


(A)

(B)

(C)

(D)
(E) None of the above

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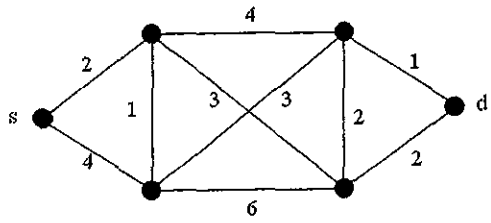
35. What is the shortest distance between node s and d in the following graph?



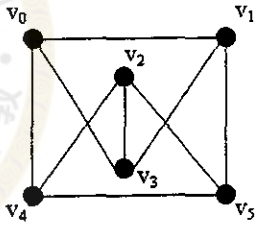
(A) 5 (B) 6 (C) 7 (D) 8 (E) 9

36. Given the following symbols with their frequencies, determine the Huffman code

Symbol	frequency
a	8
d	7
e	12
k	1
r	4
s	6

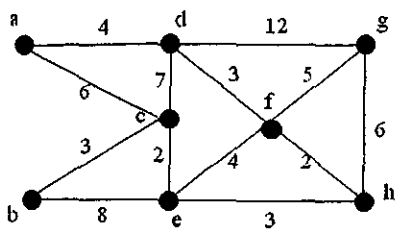
Which of the following is incorrect?
(A) a = 10 (B) k = 1000 (C) r = 1001 (D) s = 101 (E) None of the above

37. Given the graph on the right and assuming that the vertices have been ordered as labeled, find the breadth-first spanning tree. Which of the following is the order of the vertex traversed?
(A) v0, v1, v3, v4, v5, v2
(B) v0, v1, v3, v5, v4, v2
(C) v0, v1, v3, v4, v2, v5
(D) v0, v1, v3, v2, v4, v5
(E) None of the above



38. Given again the graph on the right and assuming that the vertices have been ordered as labeled, find the depth-first spanning tree. Which of the following is the order of the vertex traversed?
(A) v0, v1, v3, v4, v5, v2
(B) v0, v1, v3, v5, v4, v2
(C) v0, v1, v3, v4, v2, v5
(D) v0, v1, v3, v2, v4, v5
(E) None of the above

39. Consider the weighted graph G on the right. Which of the following shows the list of edges selected by the Kruskal's algorithm?
(A) (c,e)(f,h)(b,c)(d,f)(e,h)(a,d)(h,g)
(B) (c,e)(f,h)(b,c)(d,f)(e,h)(a,d)(f,g)
(C) (c,e)(f,h)(b,c)(d,f)(e,h)(e,f)(f,g)
(D) (a,d)(a,c)(b,c)(d,f)(f,h)(f,g)(e,h)
(E) (a,d)(d,f)(f,h)(e,h)(c,e)(b,c)(f,g)



40. Consider again the weighted graph G on the right. Which of the following shows the list of edges selected by the Prim's algorithm, starting at vertex a?
(A) (c,e)(f,h)(b,c)(d,f)(e,h)(a,d)(h,g)
(B) (c,e)(f,h)(b,c)(d,f)(e,h)(a,d)(f,g)
(C) (c,e)(f,h)(b,c)(d,f)(e,h)(e,f)(f,g)
(D) (a,d)(a,c)(b,c)(d,f)(f,h)(f,g)(e,h)
(E) (a,d)(d,f)(f,h)(e,h)(c,e)(b,c)(f,g)

試題隨卷繳回