Progress Test 2 (Algorithm, Integer, Recursion-induction, Counting)

Total points 22/32

You have ~50 minutes to answer 32 questions, every question is 1 mark.
SUBMIT ONLY UNIQUE ONE TIME!

The respondent's email address (**hieultde140192@fpt.edu.vn**) was recorded on submission of this form.

0 of 0 points

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Algorithm

6 of 7 points

7 questions

Which is the big-O of the algorithm "BUBBLE SORT for sorting a Sequence of N element" in the WORST CASE? *

1/1

- O(logN)
- O(N•logN)
- O(N)
- O(1)
- O(N^2) ✓

Which is the big-O of the algorithm "Finding the Maximum Element in a Sequence of N element"? *

1/1

- O(1)
- O(N•logN)
- O(N) ✓
- O(N^2)
- O(logN)

We say that f(x) is O(g(x)) if there are constants C and k such that |f(x)| ≤ C|g(x)| whenever x>k. Assume that f1(x)=O(g1(x)) and f2(x)=O(g2(x)). Thus, we have the fact that (f1+f2)(x) is __?__. * 1/1

- ( ) O(g1(x) + g2(x))
- ( ) O(g1(x)•g2(x))
- (•) O(max (|g1(x)|, |g2(x)|) ✓

Which two of three following cases are important when evaluating the complexity of an algorithm? * 0/1

- [ ] Worst-case
- [x] Average-case ✓
- [x] Best-case ✗

Which of the following is/are the properties of an algorithm * 1/1

- [x] Finiteness ✓
- [x] Effectiveness ✓
- [x] Generality ✓
- [x] Correctness ✓
- [x] Definiteness ✓

The big-O notation for f(x) = 4 logx + 2 is * 1/1

- (selected) O(logx) ✓
- O(x)
- O(1)

Choose the correct increasing o if the functions commonly used in big-O estimates. * 1/1

- (selected) 1 << log(n) << n << n•log(n) << n^2 << 2^n << 3^n << n! ✓
- 1 << log(n) << n << n•log(n) << n^2 << n! << 2^n << 3^n
- 1 << n << log(n) << n^2 << n•log(n) << 2^n << 3^n << n!

Integer

8 of 11 points

12 questions

Give integers a, b, c, d and positive integer m. Which of the following is/are true? * 1/1

- [x] If a ≡ b (mod m) and c ≡ d (mod m), then a + c ≡ b + d (mod m) and a•c ≡ b•d (mod m). ✓
- [x] (a+b) mod m = ((a mod m) + (b mod m)) mod m ✓
- [x] a•b mod m = ((a mod m)•(b mod m)) mod m ✓

The English Alphabet is as follows: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z. Decrypting the ciphertext message “H ALHJOLY” that was encrypted with the shift cipher with shift k = 7 produces __?__ * 1/1

- I SHUFFLE
- A TEACHER ✓ (selected)
- I TEACHER
- A SHUFFLE

Which of the following is the prime factorization of 7007? * 1/1

- $7 \cdot 7 \cdot 11 \cdot 13$ ✓ (selected)
- $49 \cdot 143$

Let us call PRN be the sequence of pseudorandom numbers generated by the linear congruential method with modulus m = 381, multiplier a = 19, increment c = 1, and seed = 0. The first three numbers of PRN are __?__. Do PRN share some important statistical properties that true random numbers have? * 0/1

- 0, 1, 19; No
- 0, 1, 20; No
- 0, 19, 1; No
- 0, 1, 20; Yes
- 0, 1, 19; Yes ✗ (selected)
- 0, 19, 1; Yes

We know the English Alphabet: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z. What is the secret message produced from the message "MEET YOU" using the Caesar cipher? *

- ○ PHHW BRX
- ◉ OGGV AQW ✗
- ○ QIIX CSXY

What are the quotient (q, thương) and remainder (r, phần dư) when –11 is divided by 3? * 1/1

- ○ q = 4 and r = -23
- ○ q = 3 and r = -20
- ○ q = -3 and r = -2
- ◉ q = -4 and r = 1 ✓

We know that "x | y means that x is a factor of y, for integers x (is not equal to 0) and y .". Let a, b, and c be integers, where a is not equal to 0. Then, we have the fact(s) that __?__. * 0/1

- [ ] if a | b and b | c, then a | c
- [x] if a | b, then a | m·b for all integers m ✓
- [ ] if a | b and a | c, then a | (b + c)

✓ Find the addition and product of a = (110) and b = (101) in binary representation, RESPECTIVELY. * 1/1

- ○ (1011) and (111101)
- ○ (11110) and (1011)
- ○ 211 and 11110
- ◉ (1011) and (11110) ✓

✓ Let a and b be positive integers. Then a / b = gcd(a, b) · lcm(a, b), where gcd and lcm are the greatest common divisor and least common multiple of two integers. * 1/1

- ◉ No ✓
- ○ Yes

✓ Every odd positive integer is prime? * 1/1

- ○ Yes
- ◉ No ✓

✗ Give integers a, b and positive integer m such that a ≡ b (mod m), i.e., a and b are congruent modulo m. Thus, we have the fact that __?__. * 0/1

- [x] a mod m = b mod m ✓
- [ ] m is a factor of a - b
- [ ] there is an integer k such that a = b + km

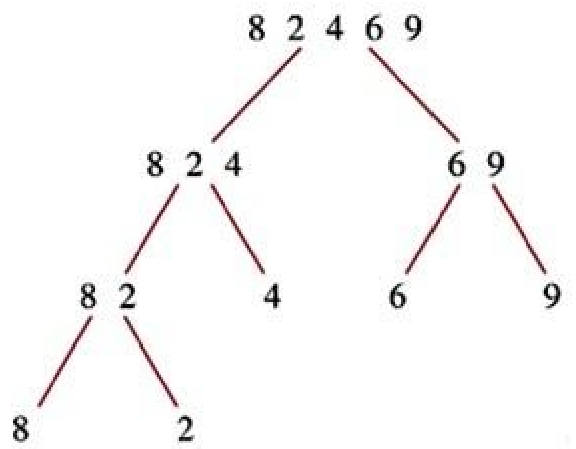
What is the least common multiple of 2^3 · 3^5 · 7^2 and 2^4 · 3^3? * 1/1

- [x] 2^4 · 3^5 · 7^2
- [ ] 2^3 · 3^3
- [ ] 2^7 · 3^8 · 7^2

Recursion-induction 6 of 8 points

7 questions

The following diagram can be used to describe the execution of the algorithm for __?__. * 1/1



- [x] Computing the summation of an array
- [x] Sorting an array by decreasing order.
- [x] Finding the maximum of an array

Chúng ta bắt đầu chơi trò xì lát. Lần đầu (lần thứ 0) ta đặt 1 đồng bị thua. Sau đó, ta đặt 2 đồng (lần thứ 1) thua nốt. Bây giờ, ta đặt 4 đồng (lần thứ 2) cũng thua luôn. Cay cú quá, ta đặt 8 đồng (lần thứ 3) thua mất tiêu. Nếu cứ mỗi lần thua, ta đặt gấp đôi. Giả sử, ở lần đặt thứ n, ta thắng và dừng cuộc chơi. Khi đó, tổng số tiền thắng cuộc sẽ là __?__. * 0/1

- (x) 2^(n-1) đồng
- ( ) 2^n đồng
- ( ) 1 đồng
- ( ) 2^(n+1) - 1 đồng

Which of the following function can be used to locate an element x in a DECREASING array by binary search method? * 1/1

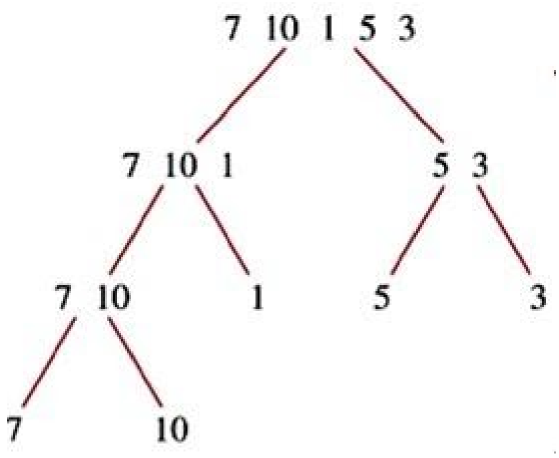
```
int bsearch(int a[100], int x, int dau, int cuoi)
{
    int giua = a[(d + c)/2];
    if (x > a[giua]) return bsearch(a, x, giua + 1, cuoi);
    if (x < a[giua]) return bsearch(a, x, dau, giua - 1);
    return giua; // x is at giua
}

int bsearch_1(int a[100], int x, int dau, int cuoi)
{
    if (dau > cuoi) return -1; // not found
    int giua = a[(d + c)/2];
    if (x > a[giua]) return bsearch_1(a, x, giua + 1, cuoi);
    if (x < a[giua]) return bsearch_1(a, x, dau, giua - 1);
    return giua; // x is at giua
}

int bsearch_2(int a[100], int x, int dau, int cuoi)
{
    if (dau > cuoi) return -1; // not found
    int giua = a[(d + c)/2];
    if (x < a[giua]) return bsearch_2(a, x, giua + 1, cuoi);
    if (x > a[giua]) return bsearch_2(a, x, dau, giua - 1);
    return giua; // x is at giua
}
```

- bsearch
- bsearch_1
- bsearch_2

The following diagram can be used to illustrate the execution of the algorithm for __?__. * 1/1



- [x] Sorting an array by decreasing order
- [x] Finding the minimum of an array
- [x] Searching the position of an element

Which of the following is/are correct recursive definition(s)? * 1/1

- ( ) Fibonacci numbers: f[0] = 0, f[1] = 1; f[n] = f[n-1] • f[n-2]
- (•) Computing b^n mod m, where b, n, and m are integers with m ≥ 2, n ≥ 0, and 1 ≤ b < m: b^0 mod m = 1; b^n mod m = (b · (b^(n−1) mod m)) mod m
- ( ) The power of a real number x by n (non-negative integer) times: x^0 = 1; x^(n+1) = x^n + x

Which of the following is/are correct recursive definition(s)? * 1/1

$$LS(x,a,i,j) = \begin{cases} i, & if\ a[i] = x \\ & else \\ 0, & if\ i > j \\ LS(x,a,i+1,j), & if\ i \le j \end{cases}$$

- ○ Factorial: 0! = 1; n! = n + (n-1)!
- ◉ LS(x, a, left, right) to search for the first occurence of x in the sequence a[left], a[left+1], ..., a[right] ✓
- ○ Let us call sum(a, n) be the summation of the sequence a[1], a[2], ..., a[n]. Then, sum(a, 0) = 0; sum(a, n) = a[n] · sum(a, n-1)

Which of the following functions can be used to determine the greatest common divisors of two integers a and b? * 0/1

```
int gcd(int a, int b)
{
    if (a == 0) return b;
    return gcd(b % a, a);
}

int gcd_1(int a, int b)
{
    if (a > b)  return gcd(a - b, b);
    return gcd(a, b - a);
}

int gcd_2(int a, int b)
{
    while (a != b)
    {
        if (a > b)  a = a - b;
        else        b = b - a;
    }
    return a;
}
```

- [ ] gcd_2
- [x] gcd_1 ✗
- [x] gcd ✓

The set S of all non-negative even integers can be recursively defined by __?__. * 1/1

- If x ∈ S, then x + 2 ∈ S.
- First, 0 ∈ S. If x ∈ S, then x + 2 ∈ S.
- S = {2 • k | k =0,1,2, ...}.

Counting

2 of 6 points

7 questions

How many bit strings of length eight either start with the two bits 00 or have bit 1 at three positions 4, 5 and 6? * 0/1

- 88
- 8
- None of the others
- 96

Suppose that the number of SARS-CoV-2 viruses in an infected people doubles every second. If the infected people begins with three viruses, how many will be present in one hour? [Should use CALCULATOR instead of Excel for computing!] *

- ○ 1152921504606846976
- ◉ 3458764513820540928 ✓
- ○ 1152921504606846979
- ○ 3600
- ○ 120

How many different license plates can be made if each plate contains a sequence of three English letters (NOT CASE-SENSITIVE) followed by three digits, given that they have distinct letters and digits? [Should use the the function POWER in Excel for computing!] * 0/1

- ○ 11232000
- ○ 95472000
- ○ 140608000
- ◉ 17576000 ✗

How many bit strings of length four which no three consecutive (liên tiếp) 0s, using a tree diagram to count. * 0/1

- ○ 13
- ○ 16
- ○ 15
- ◉ 14 ✗
- ○ 12

Each user on a computer system has an ID, which is three to five characters long, where each character is a LOWER letter or a digit. Each ID must contain at least one digit. How many possible IDs are there? [Should use the function POWER in Excel for computing!] * 0/1

- ○ 62192448
- ○ 49836520
- ○ 54065375
- ◉ 43893500 ✗

Many problems involve testing all combinations of elements of a set to see if they satisfy some property. To consider all such combinations of elements of a set V, we build a power set PS(V) that has as its members all the subsets of V. Then, the recurrence relation for PS(V) is as follows. Is that right? If yes, show the explicit formula for the cardinality of PS(V). * 1/1

For $V = \{v_1, v_2, \ldots, v_{n-1}, v_n\}$, we have:

$$PS(V) = \begin{cases} \{\emptyset\}, & if\ V = \emptyset \\ \{T \mid T \in PS(V \setminus \{v_n\})\} \cup \{T \cup \{v_n\} \mid T \in PS(V \setminus \{v_n\})\}, & else \end{cases}$$

- Yes; 2^n + 1
- Yes; 2^n - 1
- No
- (selected) Yes; 2^n ✓

A business company receives 550 applications from computer graduates for a job planning aline of new Web servers. Suppose that 243 of these applicants majored in marketing, 292 majored in accountant, and 73 majored both in marketing and in accountant. How many of these applicants majored NEITHER in marketing NOR in accountant? * 1/1

- 462
- (selected) 88 ✓
- None of the others
- 15