1 With the pseudo-code below, determine the final value of sum when n=23.

Algorithm 1

```
1: procedure

2: sum = 0

3: for (i=2, i<n, i=i+3) do

4: if i mod 2 == 0

5: sum = sum + i
```

```
2 - 0 + 1 = 1

5

6 - 1 + 8 - 10

11

14 - 10 + 14 = 24

17

20 - 1 24 + 20 = 44

15
```

- 2 Use the pseudo-code below to answer the following question.
 - (a) Without working through the pseudo-code, how many times with val be updated in Line 7?
 - (b) What is the final value of val.

Algorithm 2

```
1: procedure
2: dFour = [1, 2, 3, 4]
3: dSix = [1, 2, 3, 4, 5, 6]
4: val = 0
5: for (x in dFour) do
6: for (y in dSix) do
7: val = val + x·y
```

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> 3 Using the pseudo-code below, what is the ending value for count when n = 100? When n = 10,000? When $n = 10^{42}$?

Algorithm 3

```
1: procedure
     count=0
3:
     while (n>1) do
       count++
4:
        n = n/10
```

$$N_1 = 100 = 10^2$$
 \rightarrow county = 2
 $n_2 = 10,000 = 10^4$ \rightarrow county = 41
 $n_3 = 10^{42}$ \rightarrow county = 42

- 4 This question assumes familiarity with modular arithmetic discussed in Unit 2. In the pseudo-code below, Line 7 performs string addition (concatenation), for example:
 - "a" + "b" = "ab". Even if the addends look like numbers, it will still do string addition:
 - "2" + "3" = "23". Answer the questions below.
 - a. What is the output of the algorithm when x=99 and b=2?
 - b. What is the output of the algorithm when x=1642 and b=8?

Algorithm 4

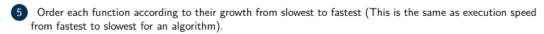
```
1: procedure Expand(x, b)
     Input: integers x and b
     Output: outVal, x written in base b
3:
4:
    outVal = an empty string
6:
    while (x>0) do
7:
       outVal = string(x mod b) + outVal
       x = x div b
     return(outVal)
```

· outval= 3/52_

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- (a) $n \cdot \log n$
- (b) $\log_{10} n$
- (c) 10^n
- (d) n^{10}
- (e) 10n
- (f) 100
- (g) n^2

6 The provided expressions are the processing time of an algorithm for problems of size n. For each expression, find the *lowest possible* Big- \mathcal{O} complexity stated in simplest form.

- (a) $100n^2 + 0.0002n^3 + 10,000$
- (b) $20n + 2n \log_{10} n + 30$
- (c) $\log_{10} 5 + \log_2 7$
- (d) $5n + \sqrt{n}$
- (e) $0.01(2^n) + n^5 + \ln n$
- (f) $100 \cdot 4^n + 200 \cdot 3^n$

7 $f(x) = 6x \log_4 x$ is which of the following? Mark all that apply.

 $\bigcirc \ \mathcal{O}(6) \quad \bigcirc \ \mathcal{O}(\log x) \quad \bigcirc \ \mathcal{O}(6\log x) \quad \bigcirc \ \mathcal{O}(x\log x) \quad \bigcirc \ \mathcal{O}(x^2) \quad \bigcirc \ \mathcal{O}(2^x)$

Since Big-0 is apperbound, $J(x) \in O(x\log x) \subset O(x^2) \setminus SO$ $O(x\log x), O(x^2) \setminus O(2x)$

8 Let $h(x) = 6x^4 + 2x^3 + x + 100$. Which of the following is true? Mark all that apply.

 $\bigcirc h(x) \in \mathcal{O}(x^4) \quad \bigcirc h(x) \in \Theta(x^4) \quad \bigcirc h(x) \in \Omega(x^4)$

D(x4) upper bound D(x4) lower bound O(x1) +ight bound