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CS-306

Pg. 1

2nd Exercises

#1 pg. 50
a. n, addition of two numbers, no
b. n^2, multiplication of two numbers, no   1. actually magnitude of n
c. number of elements in list, comparison, no
d. magnitude of both input numbers (sum), mod division, yes (we have to always check all the elements)
e. n, modulo, no

#8 pg. 51
a. $\log_2(n)$ $\log_2 4n - \log_2 n = (\log_2(4n) + \log_2(n)) - \log_2(n) = 2$
b. 4 $\frac{\sqrt{4n}}{\sqrt{n}} = \frac{16\cancel{n}}{\cancel{n}} = \sqrt{16} = 4$
c. 4 $\frac{4\cancel{n}}{\cancel{n}}$

$b^x = a \quad \log_b(a) = x$

d. 16 $\frac{(4n)^2}{(n)^2}$ $\frac{16\cancel{n^2}}{\cancel{n^2}}$
e. 64 $\frac{(4n)^3}{n^3}$ $\frac{4\cdot4\cdot4\cdot\cancel{n}\cdot\cancel{n}\cdot\cancel{n}}{\cancel{n}\cdot\cancel{n}\cdot\cancel{n}}$ 3n
f. 2^{3n} $\frac{2^{(4n)}}{2^{(n)}}$ $\cancel{\frac{\log_2(x) = 4n}{\log_2(x) = n}}$

#3 pg. 59
a. n^{10} $\frac{(n^2+1)^{10}}{n^{20}} = \frac{(n^2+1)^{10}}{(n^2)^{10}}$ $\left(\frac{n^2+1}{n^2}\right)^{10} = \left(1 + \frac{1}{n^2}\right)^{10} = 1$
infinity makes zero

b. n $\sqrt{10n^2+7n+3} = \sqrt{10n^2} = \sqrt{10}\,n = n$
d. 3^n Observation shows that 3^n is what matters
$2^{n+1} = 2\cdot 2^n \quad 3^{n-1} = \frac{1}{3} 3^n$

Pg. 2

root ↓

\#1 pg. 67

a. $1+3+5+7+9 \ldots 999$

$\boxed{250{,}000}$

0	1	1	1×1	$\frac{1}{2}=1$
1	3	4	2×2	$\frac{3}{2}=2$
4	5	9	3×3	$\frac{5}{2}=3$
9	7	16	4×4	$\frac{7}{2}=4$
16	9	25	5×5	$\frac{9}{2}=5$
25	11	36	6×6	

$\frac{999}{2}=500 \quad 500^2=250000$

b. $2+4+8+16$

$2\times2=4$ 2

$3\times2=6$ 4

$4\times2=8$ 6

$5\times2=10$ 8

0 2 2

2 4 6

6 6 12

12 8 20

20 10 30

1 0

2 2 $(2i-2$

3 4

6

8

10

$$\sum_{i=1}^{500} 2i - \sum_{i=1}^{500} 2$$

$(2i-2)$

$2(500)=1000$

$$\sum_{i=1}^{500}(2i-2)$$

i=1 2

2 4

3 6

4 8

5 10

15 = 30

2^1 12 / 42

$$\sum_{i=1}^{1024} 2i - \sum_{i=1}^{1024} 2$$

$\frac{1}{2}n^2$

1024

2048

2^1 2

2^2 4

2^3 8

2^4 16

$2^{10}=1024$

$$\sum_{i=0}^{i=10} 2^i$$

$2\left(\frac{2^{n}-1}{2-1}\right)=2040$

$$\frac{2^{(10+1)}-2}{2-1}=2046$$

2040

#1 pg. 67 (cont) c. $\sum_{i=3}^{n+1} 1$? $n=5$ $3 \to 6$

$n-1$ $1+1+1+1=4$

d. $\sum_{i=3}^{n+1} i$ $n=5$ $3\ 4\ 5\ 6$ $3+4+5+6=18$ $3\ 4\ 5\ 6\ 7$ $3\ 4\ 5\ 6\ 7=25$

$$\sum_{i=0}^{n+1} i - \sum_{i=0}^{2} i \quad \frac{n(n+1)}{2} - \frac{2(2+1)}{2} = 3$$

$$\boxed{\cancel{\frac{n(n+1)}{2} - 3}}$$

$$(n+1)(n+2)$$

$$\sum_{i=0}^{n+1} i - \sum_{i=0}^{2} i$$

$$\frac{n(n+1)}{2} + n+1-3 \quad 0\ 1\ 2 = 3$$

$$\frac{n^2+n}{2} + n - 2 \quad \boxed{\frac{1}{2}n^2 + \frac{3}{2}n - 2}$$

e. $$\sum_{i=0}^{n-1} i(i+1) = \sum_{i=0}^{n} i^2+i - (n^2+n)$$

$$\boxed{\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2} - n^2 - n}$$

#2 pg. 67 a. $\sum_{i=0}^{n-1} (i^2+1)^2$ $(i^2+1)(i^2+1)$ $i^4 + 2i^2 + 1 = \sum_{i=0}^{n-1} i^4 \in \Theta(n^x)$ where $x > 4$

b. $\sum_{i=2}^{n-1} \log_2(i^2)$ $2\log_2(i) = 2\sum_{i=2}^{n-1} \log_2(i) = 2\sum_{i=0}^{n} \log_2(i) - 2\log_2(n)$

#2 pg. 67 (con't) c. $\sum_{i=1}^{n} (i+1)2^{i-1}$ $i2^{i-1} + 2^{i-1}$? wayyy to hard!

#3 pg. 76 a. $\sum_{i=1}^{n} i^3$

1 2 3 4
3 6 9 12

Basic op. multiply 3 per iteration

$3n$

b. about the same

#6 pg 83 $2^{31} - 1$ 1 1 2 3 5 7 12 19 31...

$2^{31} - 1 =$ 2,147,483,647

change that to 63 for other answer

1 1

b = a + b 2

a = b

b = a + b 3

a = b

```
while (a+b < 2^31-1)
{
  b = a+b;
  a = b;
}
answer = b
```

$\boxed{31 = 1073741824}$

#9 pg 84 not sure... $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$