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Assignment 1

1. a) $\lim_{n\to\infty} \frac{(n^2+1)^{10}}{n^{20}} = \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^{10}\right)}{\frac{d}{dn}(n^{20})}$

$= \lim_{n\to\infty} \frac{(2n)(10)(n^2+1)^9}{20n^{19}}$

$= \lim_{n\to\infty} \frac{(n^2+1)^9}{n^{18}}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^9\right)}{\frac{d}{dn}(n^{18})}$

$= \lim_{n\to\infty} \frac{2n(9)(n^2+1)^8}{18n^{17}}$

$= \lim_{n\to\infty} \frac{(n^2+1)^8}{n^{16}}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^8\right)}{\frac{d}{dn}(n^{16})}$

$= \lim_{n\to\infty} \frac{2n(8)(n^2+1)^7}{16n^{15}}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^7\right)}{\frac{d}{dn}(n^{14})}$

$= \lim_{n\to\infty} \frac{2n(7)(n^2+1)^6}{14n^{13}}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^6\right)}{\frac{d}{dn}(n^{12})}$

$= \lim_{n\to\infty} \frac{2n(6)(n^2+1)^5}{12n^{11}}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^5\right)}{\frac{d}{dn}(n^{10})}$

$= \lim_{n\to\infty} \frac{2n(5)(n^2+1)^4}{10n^9}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^4\right)}{\frac{d}{dn}(n^8)}$

$= \lim_{n\to\infty} \frac{8n(n^2+1)^3}{8n^7}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^3\right)}{\frac{d}{dn}(n^6)}$

$= \lim_{n\to\infty} \frac{6n(n^2+1)^2}{6n^5}$

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$$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n^2+1)^2\right)}{\frac{d}{dn}(n^4)}$$

$$= \lim_{n\to\infty} \frac{4n(n^2+1)}{4n^3}$$

$$= \lim_{n\to\infty} \frac{\frac{d}{dn}(n^2+1)}{\frac{d}{dn}(n^2)}$$

$$= \lim_{n\to\infty} \frac{2n}{2n}$$

$$= 1$$

Due to the limit being a positive constant, $(n^2+1)^{10} \in \Theta(n^{20})$

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b) $\lim_{n\to\infty} \frac{\sqrt{10n^2+7n+3}}{n} = \lim_{n\to\infty} \frac{\sqrt{10}|n|}{n} + \cancel{\frac{\sqrt{7n+3}}{n}}^{0}$

$= \lim_{n\to\infty} \frac{\sqrt{10}\,|n|}{n}$

$= \pm\sqrt{10}$

Due to the limit being two constants, $\sqrt{10n^2+7n+3} \in \Theta(n)$

c) $\lim_{n\to\infty} \frac{2n\lg(n+2)^2 + (n+2)^2\lg\frac{n}{2}}{n^2\lg n} = \lim_{n\to\infty} \frac{4n\lg(n+2) + (n+2)^2\lg n - \lg 2}{n^2\lg n}$

$= \lim_{n\to\infty} \cancel{\frac{4n\lg(n+2)}{n^2\lg n}}^{0} + \frac{(n+2)^2\lg n}{n^2\lg n} - \cancel{\frac{\lg 2}{n^2\lg n}}^{0}$

$= \lim_{n\to\infty} \frac{(n^2+4n+4)\cancel{\lg n}}{n^2\cancel{\lg n}}$

$= \lim_{n\to\infty} \frac{n^2}{n^2} + \cancel{\frac{4n}{n^2}}^{0} + \cancel{\frac{4}{n^2}}^{0}$

$= 1$

Due to the limit being a positive constant, $2n\lg(n+2)^2+(n+2)^2\lg\frac{n}{2} \in \Theta(n^2\lg n)$

d) $\lim_{n\to\infty} \frac{2^{n+1}+3^{n-1}}{2^n+3^n} = \lim_{n\to\infty} \frac{2(2^n)+\frac{1}{3}(3^n)}{2^n+3^n}$

$= \lim_{n\to\infty} \frac{3^n\left(2\left(\frac{2}{3}\right)^n+\frac{1}{3}\right)}{2^n+3^n}$

$= \lim_{n\to\infty} \frac{\cancel{3^n}\left(2\left(\frac{2}{3}\right)^{n\to 0}+1/3\right)}{\cancel{3^n}\left(\left(\frac{2}{3}\right)^{n\to 0}+1\right)}$

$= \frac{2(0)+1/3}{0+1}$

$= \frac{1/3}{1}$

$= 1/3$

Due to the limit being a positive constant, $2^{n+1}+3^{n-1} \in \Theta(2^n+3^n)$

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e) $\lim_{n\to\infty} \frac{\lfloor \cancel{\log_2 n} \rfloor}{\cancel{\log_2 n}} = \lfloor 1 \rfloor = 1$

Due to the limit being a positive constant, $\lfloor \log_2 n \rfloor \in \Theta(\log_2 n)$

2. $\lim_{n\to\infty} \frac{(n-2)!}{(n-2)!} = \lim_{n\to\infty} \frac{(n-2)\times\cancel{(n-3)\times\ldots\times 1}}{(n-2)\times\cancel{(n-3)\times\ldots\times 1}}$

$= 1$

$\because 1 > 0 \rightarrow (n-2)! \in \Theta((n-2)!)$

$\lim_{n\to\infty} \frac{5\lg(n+100)^{10}}{\lg n} = 5\lim_{n\to\infty} \frac{10\lg(n+100)}{\lg n}$

$= 50 \lim_{n\to\infty} \frac{\frac{d}{dn}(\lg(n+100))}{\frac{d}{dn}(\lg n)}$

$= 50 \lim_{n\to\infty} \frac{\frac{1}{(n+100)\ln 10}}{\frac{1}{n\ln 10}}$

$= 50 \lim_{n\to\infty} \frac{n\cancel{\ln 10}}{(n+100)\cancel{\ln 10}}$

$= 50 \lim_{n\to\infty} \frac{n}{n+100}$

$= 50 \lim_{n\to\infty} \frac{\frac{d}{dn}(n)}{\frac{d}{dn}(n+100)}$

$= 50 \lim_{n\to\infty} \frac{1}{1}$

$= 50$

Due to the limit being a positive constant, $5\lg(n+100)^{10} \in \Theta(\lg n)$

$\lim_{n\to\infty} \frac{2^{2n}}{2^n} = \lim_{n\to\infty} \frac{4(\cancel{2^n})}{\cancel{2^n}}$

$= 4$

Due to the limit being a positive constant, $2^{2n} \in \Theta(2^n)$

$\lim_{n\to\infty} \frac{0.001n^4+3n^3+1}{n^4} = \lim_{n\to\infty} \frac{0.001\cancel{n^4}}{\cancel{n^4}} + \cancel{\frac{3n^3}{n^4}}^{\,0} + \cancel{\frac{1}{n^4}}^{\,0}$

$= \lim_{n\to\infty} 0.001 + 0 + 0$

$= 0.001$

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$$\lim_{n\to\infty} \frac{\ln^2(n)}{\ln^2(n)} = 1$$

Due to the limit being a positive constant, $\ln^2(n) \in \Theta(\ln^2(n))$

$$\lim_{n\to\infty} \frac{\sqrt[3]{n}}{\sqrt[3]{n}} = 1$$

Due to the limit being a positive constant, $\sqrt[3]{n} \in \Theta(\sqrt[3]{n})$

$$\lim_{n\to\infty} \frac{3^n}{3^n} = 1$$

Due to the limit being a positive constant, $3^n \in \Theta(3^n)$

Order of Growth

Lowest $\longrightarrow$ $\longleftarrow$ Highest

$$\boxed{5\lg(n+100)^{10},\ \sqrt[3]{n},\ \ln^2(n),\ 0.001n^4+3n^3+1,\ 2^{2n},\ 3^n,\ (n-2)!}$$

3. a) $\displaystyle\sum_{i=1}^{500} 2i-1 = \frac{500}{2}(1+999)$
$= 250(1000)$
$= 250000$

b) $\displaystyle\sum_{i=0}^{10} 2^i = 2^{10+1}-1 = 2^{11}-1 = 2047$

c) $\displaystyle\sum_{i=3}^{n+1} 1 = (n+1)-3+1 = n-1$

d) $\displaystyle\sum_{i=3}^{n+1} i = \frac{(n+1)(n+2)}{2} = \frac{n^2+3n+2}{2}$

e) $\displaystyle\sum_{i=0}^{n-1} i(i+1) = \frac{(n-1)(n)(2n-1)}{6} + \frac{(n-1)(n)}{2}$

$= \dfrac{(n^2-n)(2n-1)}{6} + \dfrac{n^2-n}{2}$

$= \dfrac{2n^3-3n^2+n}{6} + \dfrac{n^2-n}{2}$

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f) $\sum_{j=1}^{n} 3^{j+1} = \sum_{j=1}^{n} 3^{j} + 3\sum_{j=1}^{n} 1$

$= \frac{3^{j+1}-1}{3-1} + 3(n-1+1)$

$= \frac{3^{j+1}-1}{2} + 3n$

g) $\sum_{i=1}^{n}\sum_{j=1}^{n} ij = \sum_{i=1}^{n} i \times \sum_{j=1}^{n} j$

$= \frac{n^2+n}{2} \times \frac{n^2+n}{2} = \left(\frac{n^2+n}{2}\right)^2$

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

$\gamma = 0.5772$

$= n + \ln(n) + \gamma$

$= ($

4\. a) $\sum_{i=0}^{n-1} (i^2+1)^2 = \sum_{i=0}^{n-1} (i^4+2i^2+1) = \sum_{i=0}^{n-1} i^4 + 2\sum_{i=0}^{n-1} i^2 + \sum_{i=0}^{n-1} 1$

$= \frac{1}{5}(n-1)^5 + \frac{2}{3}(n-1)^3 + (n-1-0+1)$

$= \frac{1}{5}(n-1)^5 + \frac{2}{3}(n-1)^3 + n$

$\lim_{n\to\infty} \frac{\frac{1}{5}(n-1)^5 + \frac{2}{3}(n-1)^3 + n}{n^5} = \lim_{n\to\infty} \frac{\frac{d}{dn}\left(\frac{1}{5}(n-1)^5 + \frac{2}{3}(n-1)^3 + n\right)}{\frac{d}{dn}(n^5)}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n-1)^4 + 2(n-1)^2 + 1\right)}{\frac{d}{dn}(5n^4)}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left((n-1)^3 + (n-1)\right)}{\frac{d}{dn}(5n^3)}$

$= \lim_{n\to\infty} \frac{\frac{d}{dn}\left(3(n-1)^2 + 1\right)}{\frac{d}{dn}(15n^2)}$

$= \lim_{n\to\infty} \frac{n-1}{5n}$

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$$= \frac{1}{5} \lim_{n \to \infty} \frac{d/dn\,(n-1)}{d/dn\,(n)}$$

$$= \frac{1}{5} \lim_{n \to \infty} 1 \quad = 1/5$$

Due to the limit being a positive constant,

$$\sum_{i=0}^{n-1} (i^2+1)^2 \in \Theta(n^5)$$

b) $$\sum_{i=2}^{n-1} \lg i^2 = \sum_{i=2}^{n-1} \lg i \times \sum_{i=2}^{n-1} i - \lg 1$$

$$= (n-1)\lg(n-1) \times \frac{(n-1)(n)}{2} = \frac{n(n-1)^2 \lg(n-1)}{2}$$

$$= \frac{1}{2} \lim_{n \to \infty} \frac{(n^3-2n^2+2n)\lg(n-1)}{n^3 \lg n} = \lim_{n \to \infty} \frac{(n^3-2n^2+2n)}{n^3} \times \frac{\lg(n-1)}{\lg n}$$

$$= \lim_{n \to \infty} \frac{n^3}{n^3} - \cancel{\frac{2}{n}}^{0} + \cancel{\frac{2}{n^2}}^{0} \times \frac{\lg(n-1)}{\lg n}$$

$$= \lim_{n \to \infty} 1 \times \frac{\lg(n-1)}{\lg n}$$

$$= \lim_{n \to \infty} \frac{d/dn\,(\lg(n-1))}{d/dn\,(\lg n)}$$

$$= \lim_{n \to \infty} \frac{1/(n-1)\ln(10)}{1/n\ln(10)}$$

$$= \lim_{n \to \infty} \frac{n\,\cancel{\ln(10)}}{(n-1)\,\cancel{\ln(10)}}$$

$$= \lim_{n \to \infty} \frac{d/dn\,(n)}{d/dn\,(n-1)}$$

$$= \lim_{n \to \infty} \frac{1}{1} = 1$$

Due to the limit being a positive constant,

$$\sum_{i=2}^{n-1} \lg i^2 \in \Theta(n^3 \lg n)$$

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c) $\sum_{i=1}^{n} (i+1)2^{i-1} = \left(\sum_{i=1}^{n} i + \sum_{i=1}^{n} 1\right) \times \left(\sum_{i=1}^{n} 2^i - 1\right) \times \frac{1}{2}\sum_{i=1}^{n} 1$

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

$= \left(\frac{n^2+3n}{2}\right) \times \left(2^{n+1} - 2\right) \times \frac{n}{2}$

$= \left(\frac{n^2+3n}{2} \times 2^n \times \frac{n}{2}\right)$

$= \frac{n^2(n+3)2^n}{4}$

$\lim_{n\to\infty} \frac{\frac{1}{4}n^2(n+3)(2^n)}{n^3 2^n} = \frac{1}{4} \lim_{n\to\infty} \frac{\cancel{2^n}(n^3+3n^2)}{n^3 \cancel{2^n}}$

$= \frac{1}{4} \lim_{n\to\infty} \frac{n^3+3n^2}{n^3}$

$= \frac{1}{4} \lim_{n\to\infty} \frac{n^3}{n^3} + \cancel{\frac{3n^2}{n^3}}^{0}$

$= 1/4$

Due to the limit being a positive constant,
$\frac{1}{4}n^2(n+3)2^n \in \Theta(n^3 2^n)$

d) $\sum_{i=0}^{n-1} \sum_{j=0}^{i-1} (i+j) = \sum_{i=0}^{n-1}\left(\sum_{j=0}^{i-1} i + \sum_{j=0}^{i-1} j\right)$ constant here

$= \sum_{i=0}^{n-1} i\left(\sum_{j=0}^{i-1} 1 + \sum_{j=0}^{i-1} j\right)$

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

$= \sum_{i=0}^{n-1} i\left(i + \frac{1}{2}i^2 - i/2\right)$

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

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

$$= \frac{1}{2}\left(\frac{(n-1)n(2n-1)}{6} + \frac{1}{4}(n-1)^4\right)$$

$$= \frac{1}{4}\left(\frac{2n^3-3n^2+n}{3} + \frac{(n-1)^4}{2}\right)$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{\frac{d}{dn}\left(\frac{2n^3-3n^2+n}{3} + \frac{(n-1)^4}{2}\right)}{\frac{d}{dn}(n^4)}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{\frac{d}{dn}\left(\frac{1}{3}(6n^2-6n+1) + 4(n-1)^3\right)}{\frac{d}{dn}(4n^3)}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{\frac{1}{3}(12n-6) + 12(n-1)^2}{12n^2}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{\frac{d}{dn}\left((2n-1) + 2(n-1)^2\right)}{\frac{d}{dn}(6n^2)}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{2+4n-4}{12n}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{2n-1}{6n}$$

$$= \frac{1}{4}\lim_{n\to\infty} \frac{n}{3n} - \cancel{\frac{1}{6n}}^{\,0}$$

$$= \frac{1}{4}\left(\frac{1}{3}\right)$$

$$= \frac{1}{12}$$

Due to the limit being a positive constant,

$$\frac{1}{4}\left(\frac{2n^3-3n^2+n}{3} + \frac{(n-1)^4}{2}\right) \in \Theta(n^4)$$

5. Formula #1:

(1) $\dfrac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}$ $\qquad$ (2) $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$

(2) $\begin{cases} M(n) = 0 \\ D(n) = 1 \\ S(n) = 0 \\ A(n) = n-1 \end{cases}$

(1) $\begin{cases} M(n) = n-1 \\ D(n) = 1(n-1)+1 \\ S(n) = n-1+1 \\ A(n) = (n-1)(n-1) \end{cases}$

The total operations for this formula are $M(n) = n-1$, $D(n) = n$, $S = n$, $A(n) = (n-1)^2$

Formula #2:

$$\frac{\sum_{i=1}^{n} x_i^2 - \dfrac{\left(\sum_{i=1}^{n} x_i\right)^2}{2}}{n-1}$$

$\xrightarrow{\text{subset}}$ $\begin{cases} M(n) = 1 \\ D(n) = 1 \\ S(n) = 0 \\ A(n) = n-1 \end{cases}$

entire formula $\begin{cases} M(n) = 2(n-1) \\ D(n) = n-1+1 \\ S(n) = n-1+1 \\ A(n) = (n-1)(n-1) \end{cases}$

The total operations for this formula is $M(n) = 2n-2$, $D(n) = n$, $S(n) = n$, $A(n) = (n-1)^2$

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6. a) This algorithm will sort an array numbers from greatest on the left to lowest on the right.

b) The basic operation is the if $A[j] > A[i]$

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

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

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

Thus, the basic operation is executed n^2 times

d) $\lim_{n \to \infty} \frac{n^2}{n^2} = 1$

Due to the limit being a positive constant, $n^2 \in \Theta(n^2)$

The efficiency class is n^2.

7. a) $A(n) = 3^1 A(n-1)$ $\qquad A(n-1) = 3A(n-2)$

$A(n) = 3^2 A(n-2)$ $\qquad A(n-2) = 3A(n-3)$

$A(n) = 3^3 A(n-3)$

$A(n) = 3^i A(n-i)$ $\qquad$ Let $i = n-1$

$A(n) = 3^{n-1} A(n-n+1)$

$A(n) = \frac{4}{3}(3^n)$ $\qquad$ The solution to this recurrence equation is $A(n) = 3^n(\frac{4}{3})$

b) $A(n) = A(n-1) + 5$ $\qquad A(n-1) = A(n-2) + 5$

$A(n) = A(n-2) + 10$ $\qquad A(n-2) = A(n-3) + 5$

$A(n) = A(n-3) + 15$

$A(n) = A(n-i) + 5i$ $\qquad$ Let $i = n-1$

$A(n) = A(n-n+1) + 5(n-1)$

$A(n) = 5n - 5$

The solution to this recurrence equation is $A(n) = 5n - 5$

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c) $A(n) = A(n-1) + n$ $\quad A(n-1) = A(n-2) + n$

$A(n) = A(n-2) + 2n$ $\quad A(n-2) = A(n-3) + n$

$A(n) = A(n-3) + 3n$

$A(n) = A(n-i) + i(n)$ $\quad$ Let $i = n$

$A(n) = A(n-n) + n^2$

$A(n) = n^2$

The solution to this recurrence equation is $A(n) = n^2$

d) $A(n) = A(n/5) + 1$ $\quad A(5^0) = 1$

$A(5^k) = A(5^{k-1}) + 1$ $\quad A(5^{k-1}) = A(5^{k-2}) + 1$

$A(5^k) = A(5^{k-2}) + 2$ $\quad A(5^{k-2}) = A(5^{k-3}) + 1$

$A(5^k) = A(5^{k-3}) + 3$

$A(5^k) = A(5^{k-i}) + i$ $\quad i = k$

$A(5^k) = A(5^{k-k}) + k$

$A(5^k) = k$

$k = \log_2 n$

The solution to this recurrence equation is $A(n) = \log_2 n$

8. a) This algorithm computes the sum of the squared for all the numbers starting at 1 and leading up to n.

b) The basic operation is the multiplication in the recursive call.

c) $M(n) = M(n-1) + 1$ $\quad M(1) = 0$

$M(n) = M(n-2) + 2$ $\quad M(n-1) = M(n-2) + 1$

$M(n) = M(n-i) + i$ $\quad i = n-1$

$M(n) = M(n-n+1) + n-1$

$M(n) = n-1$

The basic operation will get called $n-1$ times for all $n \geq 1$.

d) $\lim_{n\to\infty} \frac{n-1}{n} = \lim_{n\to\infty} \frac{n}{n} - \cancel{\frac{1}{n}}^{0}$

$= 1$

The efficiency class would be $\Theta(n)$ where $n-1 \in \Theta(n)$

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Let $n=4$

9. a) $Q(n)=Q(n-1)+2n-1$ This algorithm will compute the sum of all odd integers up to n.

$Q(4)=Q(3)+7=16$
$Q(3)=Q(2)+5=9$
$Q(2)=Q(1)+3=4$

b) $M(n)=M(n-1)+1$ $\quad M(n-1)=M(n-2)+1$ $\quad M(1)=0$
$M(n)=M(n-2)+2$ $\quad M(n-2)=M(n-3)+1$
$M(n)=M(n-3)+3$
$M(n)=M(n-i)+i$ $\quad i=n-1$
$M(n)=M(n-n+1)+n-1$
$M(n)=n-1$

There are $n-1$ multiplications made.

c) $A(n)=A(n-1)+2(1)$ $\quad A(n-1)=A(n-2)+2$ $\quad A(1)=0$
$A(n)=A(n-2)+2(2)$ $\quad A(n-2)=A(n-3)+2$
$A(n)=A(n-3)+2(3)$
$A(n)=A(n-i)+2i$ $\quad i=n-1$
$A(n)=A(n-n+1)+2(n-1)$
$A(n)=2(n-1)$

There are $2n-2$ additions and subtractions made.

10. $A(n)+2A(n-1)-8A(n-2)=10$ $\quad A(0)=0 \quad A(1)=14$

$A(n)+2A(n-1)-8A(n-2)=0$
$r^2+2r-8=0$
$(r-2)(r+4)=0$
$r_1=2 \quad r_2=-4$
$A(n)=\alpha(2)^n+\beta \cancel{n}(-4)^n$

$s-6s+9s=10$
$4s=10$
$s=10/4$

$A(n)=\alpha(2)^n+\beta n(-4)^n+10/4$

$\begin{cases}\alpha\cdot 2^0+\beta\cdot 0\cdot(-4)^0+10/4=0\\ \alpha\cdot 2^1+\beta\cdot 1\cdot(-4)^1+10/4=14\end{cases}$

$\begin{cases}\alpha \qquad +10/4=0\\ 2\alpha-4\beta \quad +10/4=0\end{cases}$

$\alpha=-10/4$ $\quad 4\beta=2\alpha+10/4$
$4\beta=-10/4$
$\beta=-10/16$
$\beta=-5/8$

$\therefore A(n)=-10/4(2)^n-5/8\,n(-4)^n$