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WA.1

1) a) $f_1(n) = \sum_{i=0}^{n}(2i)$ Apply R_1

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

$= 2\sum_{i=1}^{n} i = \cancel{2}\left(\frac{n(n+1)}{\cancel{2}}\right)$ Apply R_7

$= n(n+1)$

$= \boxed{n^2+n}$

Big-O bound : $O(n^2)$

b) $f_2(n) = \sum_{i=1}^{n} 2^i$

$= \boxed{2^{n+1}-1}$ apply R8

$= 2 \cdot 2^n - 1$

Big-O bound : $O(2^n)$

c) $f_3(n) = \sum_{i=1}^{\log(n)} 3(n) = 3\sum_{i=1}^{\log(n)}(n)$ Apply R_1

$= 3\frac{\log(n)(\log(n)+1)}{2}$ Apply R_7.

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

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

Big-O bound : $O(\log^2 n)$

d) $f_4(n) = \sum_{i=1}^{\log(n)} i$

$= \frac{\log(n)(\log(n)+1)}{2}$ Apply R_7

$= \boxed{\frac{1}{2}(\log^2(n) + \log(n))}$

Big-O bound: $O(\log^2 n)$

e) $f_5(n) = \sum_{i=1}^{\log(n)}(O(1)2^i)$

$= O(1)\sum_{i=1}^{\log(n)} 2^i$ Apply R_1

$= O(1)\cdot(2^{\log(n)+1} - 1)$

Big-O bound: $O(1)$

f) $f_6(n) = \sum_{i=1}^{n} i \log(n)$

$= \log(n) \cdot \sum_{i=1}^{n} i$ Apply R_1

$= \log(n) \cdot \frac{n(n+1)}{2}$ Apply R_7

$= \boxed{\frac{1}{2}(n^2 \log(n) + n \log(n))}$ Big-O bound: $O(n^2 \log n)$

g) $f_7(n) = \sum_{i=1}^{n} \log(i)$

$= \log(i) + \log(i+1) \cdots\cdots + \log(n-1) + \log(n)$ Apply R_5

for $1 \leq n$

$= n \log(n)$ Big-O bound: $O(n \log n)$

h) $c < d < e < g < a < f < a$