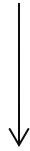


$$1. T(n-2) = T(n-3) * (n-2) \quad T(0)=1$$

$$T(n) = T(n-1) * n \dots\dots\dots 1 \text{ time}$$

$$= T(n-2) * (n-1) * n \dots\dots\dots 2 \text{ time}$$

$$= T(n-3) * (n-2) * (n-1) * (n-0) \dots\dots\dots 3 \text{ time}$$



$$= T(n-k) * (n-(n-1)) * (n-(k-2)) \dots\dots\dots (n-1) * n$$

$$n-k = 0$$

$$k = n$$

$$= T(0) * 1 * 2 * 3 * 4 \dots\dots (n-2) * (n-1) * n$$

$$= n * (n-1) * (n-2) * (n-3) * \dots * 3 * 2 * 1$$

$$T(n) = n!$$

$$= \Omega(2^n)$$

$$= O(n^n)$$

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

$$T(n) = T(n-1) + \frac{1}{n} \dots\dots\dots 1^{\text{st}} \text{ time}$$

$$= T(n-2) + \frac{1}{n-1} + \frac{1}{n} \dots\dots\dots 2^{\text{nd}} \text{ time}$$

$$= T(n-3) + \frac{1}{n-2} + \frac{1}{n-1} + \frac{1}{n} \dots\dots 3^{\text{rd}} \text{ time}$$



$$= T(n-k) + \frac{1}{n-(k-1)} + \frac{1}{n-(k-2)} + \dots + \frac{1}{n}$$

$$n-k = 0$$

$$k = n$$

$$T(n) = T(0) + \frac{1}{1} + \frac{1}{2} + \frac{1}{3} \dots \dots \dots + \frac{1}{n}$$

$$T(n) = 1 + \log n$$

$$T(n) = O(\log n)$$

$$3. \quad T(n/2^2) = 2T(n/2^3) + 4n/2^2 \quad T(1) = 4$$

$$T(n/2) = 2T(n/2^2) + 4n/2$$

$$\begin{aligned} T(n) &= 2T(n/2) + 4n \dots 1^{\text{st}} \text{ time} \\ &= 2 * 2T(n/2^2) + 4n + 4n \dots 2^{\text{nd}} \text{ time} \\ &= 2^3 T(n/2^3) + 3 * 4n \dots 3^{\text{rd}} \text{ time} \end{aligned}$$



$$= 2^k T(n/2^k) + k * 4n$$

$$n/2^k = 1$$

$$k = \log n$$

$$T(n) = 2^{\log n} T(n/2^{\log n}) + \log n * 4n$$

$$= 4n + 4n \log n$$

$$T(n) = O(n \log n)$$

$$4. \quad T(n) = T(n/2) + n \quad T(1) = 1$$

$$T(n) = T(n/2^2) + n/2 + n$$

$$= T(n/2^3) + n/2^2 + n/2 + n$$



$$= T(n/2^k) + n/2^{k-1} + n/2^{k-2} + \dots + n$$

$$n/2^k = 1$$

$$k = \log n$$

$$T(n) = T(n / 2^{\log n}) + n/(2^{\log n - 1}) + n/2^{\log n - 2} + \dots + n$$

$$= T(1) + 2 + 2^2 + 2^3 + \dots + 2^{\log n}$$

$$= 1 + [2 + 2^2 + \dots + 2^{\log n}]$$

$$a + ar + ar^2 + ar^3 + \dots + ar^k = a(r^{k+1} - 1)/(r - 1)$$

$$a = 2 \quad r = 2$$

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

$$= 1 + 2(n - 1)$$

$$= 2n - 1$$

$$= O(n)$$