Time complexity of recursive Fibonacci program

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For seed values F(0) = 0 and F(1) = 1
F(n) = F(n-1) + F(n-2)
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Çözüm:

$$T(n)=T(n-1)+T(n-2)+O(1).$$

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

$$x^2 = x+1$$

$$x^2 - x-1 = 0$$

$x = (1+\sqrt{5})/2$ and $x=(1-\sqrt{5})/2$

$$F(n) = (\alpha_1)^n + (\alpha_2)^n$$

$$F(n) = ((1+\sqrt{5})/2)^n+((1-\sqrt{5})/2)^n$$

$$F(n) = ((1+\sqrt{5})/2)^n+((1-\sqrt{5})/2)^n$$

$$T(n) = O(((1+\sqrt{5})/2)^n + ((1-\sqrt{5})/2)^n)$$

$$T(n) = O(((1+\sqrt{5})/2)^n$$

$$T(n) = O(1.6180)^n$$

ÖRNEK 2:

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

$$x^2 - x - 2 = 0.$$

$$x_1 = \frac{1+3}{2} = 2 \text{ and } x_2 = \frac{1-3}{2} = -1.$$

$$T(n) = A\,2^n + B\,(-1)^n$$

$$T(n) = \Theta(2^n).$$

ÖRNEK 3:

$$T(n) = 3T(n-1) + 4T(n-2) + 1$$

$$x^2 - 3x - 4 = 0.$$

$$x_1 = \frac{3+5}{2} = 4 \text{ and } \quad x_2 = \frac{3-5}{2} = -1.$$

$$T(n) = A\,4^n + B\,(-1)^n + C\,1^n$$

$$T(n) = \Theta(4^n).$$