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QUESTION 7

5 marks

Consider the following recurrence: $T(n) = 2T(n^{1/2}) + 1$ $T(1) = 1$ Which of the following is true?

☐ $T(n) = O(\log \log n)$

☒ $T(n) = O(\log n)$

☐ $T(n) = O(n^{1/2})$

☐ $T(n) = O(n)$

Your submitted response was correct.

Explanation

This is a Special Case of Master theorem in which the expression is not in the form of $T(n) = aT(n/b) + \Theta(n^k \log^p n)$.

So, we will substitute $n = 2^m$ to solve this expression.

$$T(n) = 2T(n^{1/2}) + 1$$

$$\Rightarrow T(2^m) = 2T(2^{m/2}) + 1$$

Take $S(m) = T(2^m)$

$$S(m) = 2S(m/2) + 1$$

Applying Master Theorem,

$$a = 2, b = 2, k = 0, p = 0 \quad | \quad 2 > 2^0 \quad [6uI]$$

$$T(m) = \Theta(m \log^0 m)$$

$$\Theta(m)$$

Now, $2^m = n$

$$\Rightarrow \log n = m$$

$T(n) = \Theta(\log n)$ Ans

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