Algorithm Design

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John Wiley & Sons

Solution of Exercise C-10.11

Divide X into two sets X_1 and X_2 of equal size $(n/2)$, and recursively construct polynomials $p_1(n)$ and $p_2(n)$, such that $p_1(X_1) = 0$ and $p_2(X_2) = 0$. Then use the FFT algorithm to compute the polynomial $p_1 \cdot p_2$. This algorithm satisfies the recurrence $T(n) = 2T(n/2) + bn\log n$, for some constant b, which implies that $T(n)$ is $O(n\log n)$ by the master theorem.