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Master's theorem

i) $T(n) = 8T(n/2) + 1000 n^2$, $T(1) = 1$

Here, $a = 8$, $b = 2$, $d = 2$

Since $a > b^d$

$$T(n) \in \Theta(n^{\log_b a})$$
$$= \Theta(n^{\log_2 8})$$
$$\therefore T(n) \in \Theta(n^3)$$

ii) $T(n) = 2T(n/2) + n^2$, $T(1) = 1$

Here $a = 2$, $b = 2$, and $d = 2$

Since $a < b^d$

$$T(n) \in \Theta(n^d)$$
$$= \Theta(n^2)$$
$$\therefore T(n) \in \Theta(n^2)$$

iii) $T(n) = 2T(n/2) + 10(n)$

Here, $a = 2$, $b = 2$ and $d = 1$, $p = 0$

Since $a = b^d$

$$T(n) \in \Theta(n^d \log^{p+1} n)$$
$$= \Theta(n \log^{o+1} n)$$
$$\therefore T(n) = \Theta(n \log n)$$