The Master theorem

Let $a \geq 1$ and $b > 1$ be constants. Let $f(n)$ be an asymptotically positive function, and let $T(n)$ be defined on the nonnegative integers by the recurrence relation:

$$T(n) = aT\left(\frac{n}{b}\right) + f(n)$$

where n/b stands for either $\lfloor n/b \rfloor$ or $\lceil n/b \rceil$.

We have that

1. If $f(n) = O(n^{\log_b a - \epsilon})$ for some constant $\epsilon > 0$, then $T(n) = \Theta(n^{\log_b a})$
2. If $f(n) = \Theta(n^{\log_b a})$, then $T(n) = \Theta(n^{\log_b a} \log n)$
3. If $f(n) = \Omega(n^{\log_b a + \epsilon})$ for some constant $\epsilon > 0$ and if $af(n/b) \leq cf(n)$ for some constant $c < 1$ and n large enough, then $T(n) = \Theta(f(n))$