

The worse case running time of insertion sort, is normally dictated as such

$$T(n) = \begin{cases} c_1 & n = 1 \\ T(n-1) + c_2n & n > 1 \end{cases}$$

With this change, the new equation will be

$$T(n) = \begin{cases} c_1 & n = 1 \\ T(n-1) + c_2 \lg n & n > 1 \end{cases}$$

It is easy to see how our new  $T(n)$  thus becomes  $c_1 + c_2 \lg n! = \Theta(n \lg n)$ .  
(The proof for the previous step is given very nicely [here](#).)