You will find the code for this question in the `RL-book/Assignment12/assignment12_code.py` file along with some comments.

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CME 241: Assignment 12 : Problem 3:

let us prove that the MC error can be written as the sum of discounted TD errors.

We will work on the expression : $E = \sum_{u=t}^{T-1} \gamma^{u-t} \left(R_{u+1} + \gamma V(S_{u+1}) - V(S_u) \right)$

$$E = \sum_{u=t}^{T-1} \gamma^{u-t} R_{u+1} + \sum_{u=t}^{T-1} \gamma^{(u+1)-t} V(S_{u+1}) - \gamma^{u-t} V(S_u)$$

The second term is a telescopic sum. This gives us

$$E = \sum_{u=t}^{T-1} \gamma^{u-t} R_{u+1} + \gamma^{T-t} V(S_T) - V(S_t)$$

And we recognize in the first terms the expression of $G_t = \sum_{u=t}^{T-1} \gamma^{u-t} R_{u+1} + \gamma^{T-t} V(S_T)$ for an experience that ends with a finite T number of steps.

Hence : $E = G_t - V(S_t) = \sum_{u=t}^{T-1} \gamma^{u-t} \left(R_{u+1} + \gamma V(S_{u+1}) - V(S_u) \right)$: we have proven the equation.

Using the code in `RL-book/Assignment12/assignment12_code.py` and my Tabular implementation of the `TD(`λ`)` Prediction algorithm, I got the following graph of convergence for different values of λ.