# Advanced Microeconomics II
# Quiz 3

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1. Consider the following extensive form game of perfect information, $\Gamma = \{\{1,2\}, H, P, u_1, u_2\}$ where

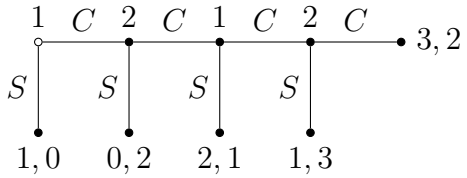
   - $H$ consists of all sequences $C(t) = (C, \ldots, C)$ of length $t$ for $0 \leq t \leq 4$ and all sequences $S(t) = (C, \ldots, C, S)$ consisting of $t-1$ $C$s for $1 \leq t \leq 4$.
   - $P(C(t)) = 1$ if $t$ is even and $t < 4$, $P(C(t)) = 2$ if $t$ is odd.

   $$u_1(S(t)) = \begin{cases} (t+1)/2 & \text{if } t \text{ is odd} \\ t/2 - 1 & \text{if } t \text{ is even} \end{cases} \qquad u_2(S(t)) = \begin{cases} (t-1)/2 & \text{if } t \text{ is odd} \\ t/2 + 1 & \text{if } t \text{ is even} \end{cases}$$

   $$u_1(C(4)) = 3 \qquad u_2(C(4)) = 2$$

   (a) (2 points) Draw the game tree and associated payoffs.

   **Solution:**

   (b) (2 points) Construct a sub-game perfect equilibrium of this game.

   **Solution:** $s_1(\varnothing) = S, s_2(C) = S, s_1(CC) = S, s_2(CCC) = S$

   (c) (3 points) Construt a Nash equilibrium of this game that is not a sub-game perfect equilibrium.

   **Solution:** There are three possible solutions.

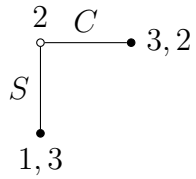
   (i) $s_1(\varnothing) = S, s_2(C) = S, s_1(CC) = S, s_2(CCC) = C$

   (ii) $s_1(\varnothing) = S, s_2(C) = S, s_1(CC) = C, s_2(CCC) = S$

   (iii) $s_1(\varnothing) = S, s_2(C) = S, s_1(CC) = C, s_2(CCC) = C$

   (d) (3 points) From the Nash equilibrium you constructed above define a sub-game and profitable one-shot deviation that deviates from the Nash equilibrium strategies only at the initial history. A game tree with arrows that reflect strategies is sufficient.

**Solution:** For the first and third Nash equilibrium identified above the following represents a subgame with a one-shot profitable deviation where the strategy is $s_2(\varnothing) = S$.




For the second Nash equilibrium identified above the following represents a subgame with a one-shot profitable deviation where the strategies are $s_1(\varnothing) = S, s_2(C) = S$.