QLearning For Videogames

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CIS 510: Multi-Agent Systems
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What is Q-Learning?

- Markov Decision Processes (MDPs) can represent decision making processes with random outcomes.

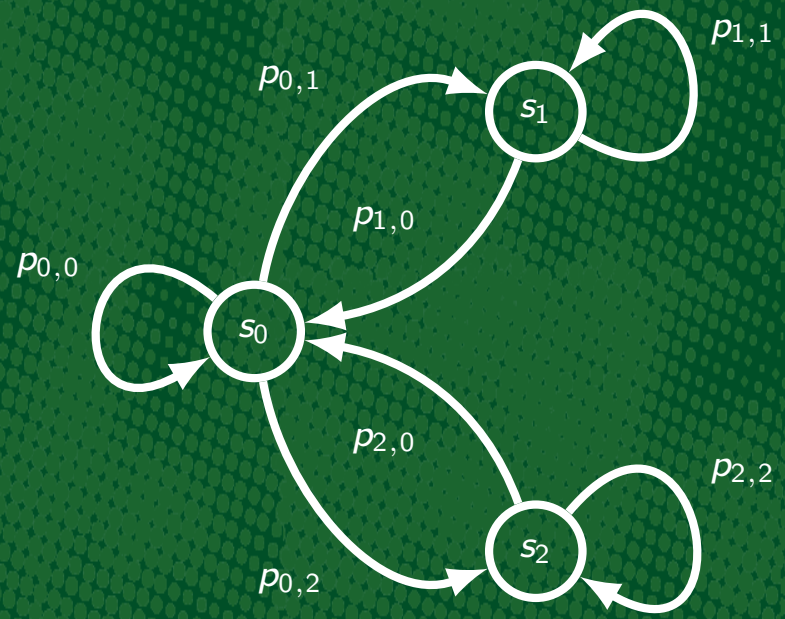

Figure: Sample Markov Decision Process

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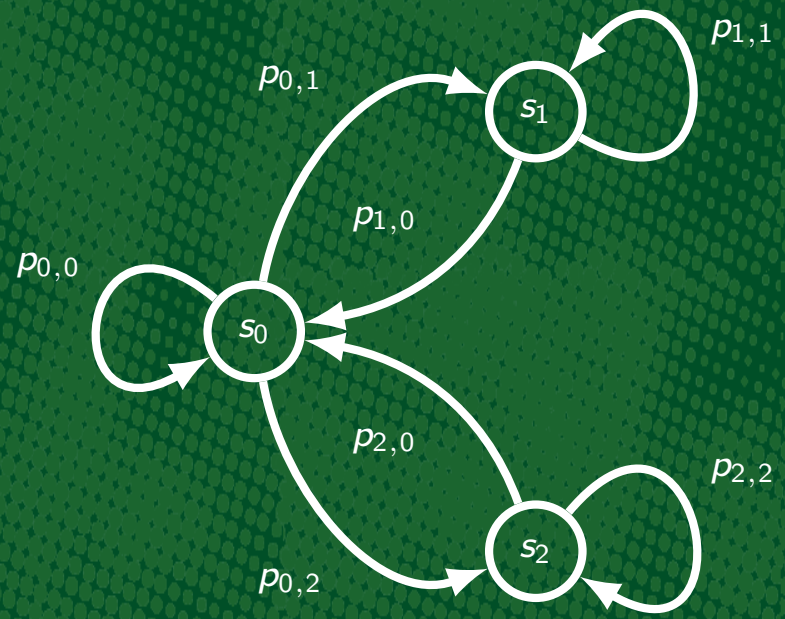
- We want to find an optimal policy (set of actions)



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What is Q-Learning?

- Markov Decision Processes (MDPs) can represent decision making processes with random outcomes.
- We want to find an optimal policy (set of actions)
- We learn with the Bellman Equation, using an iterative process

$Q(s, a) = Q(s, a) + \alpha(r + \gamma \max_{a'} Q(s', a') - Q(s, a))$

$\alpha =$ learning rate

$r =$ reward

$\gamma =$ discount

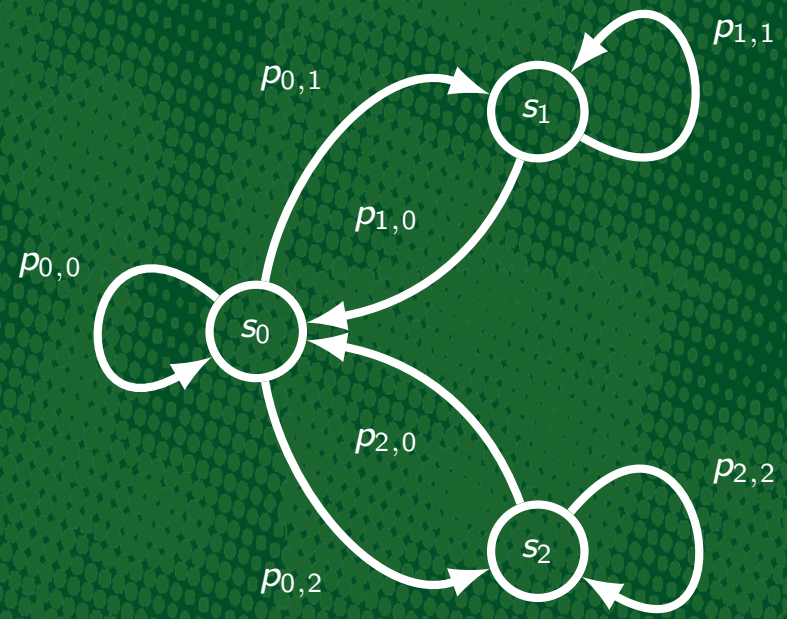


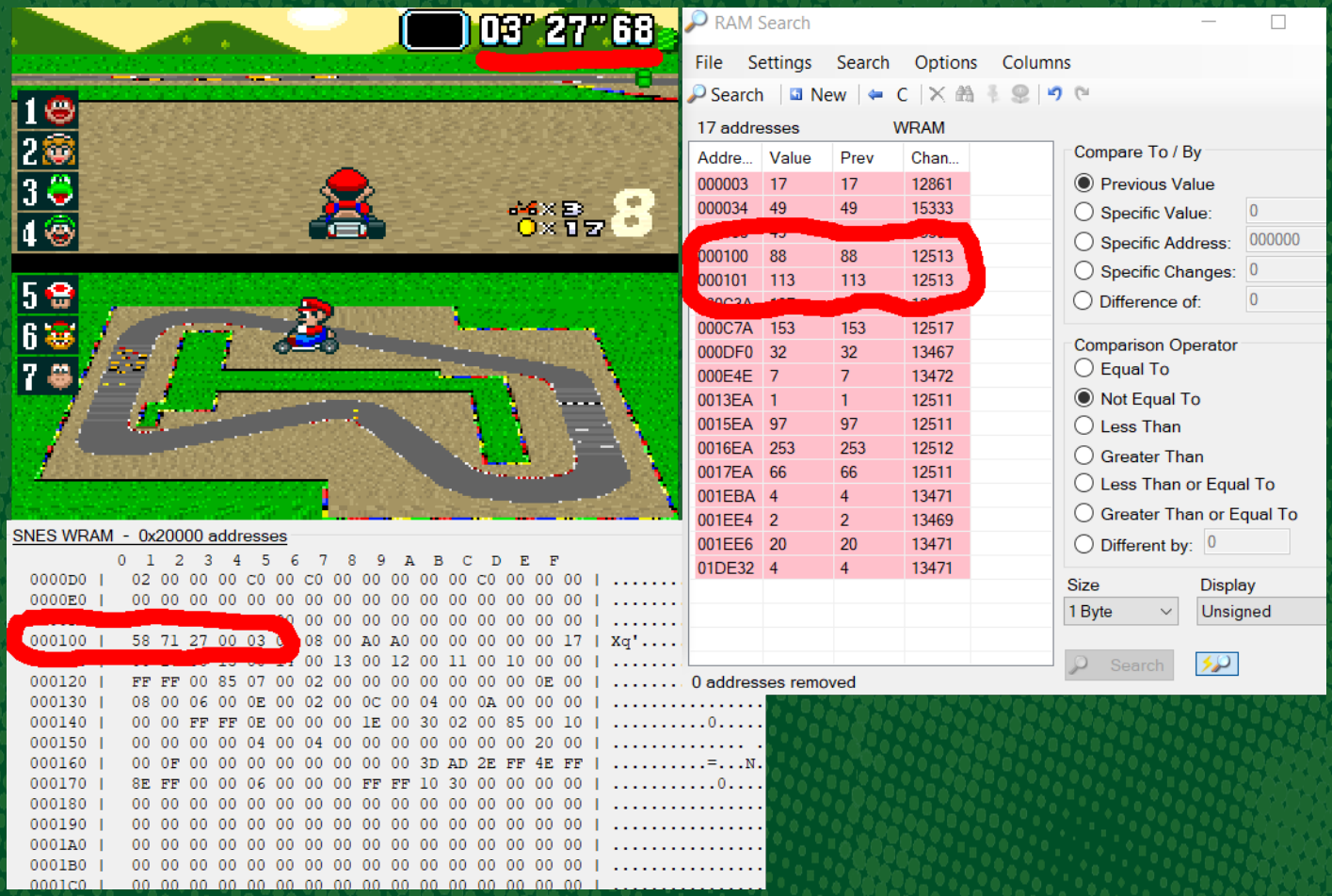
Figure: Sample Markov Decision Process

Framework

- OpenAI Gym: Allows for abstracts out environments and allows researchers to focus on creating algorithms.
- OpenAI Retro: Wrapps Gym framework to focus on retro videogames.
- Allows same code to be run on any game that is integrated.
- Creates an environment to (supposedly) allow for easy integration of new games

Integration

- Need to collect RAM values (used BizHawk).



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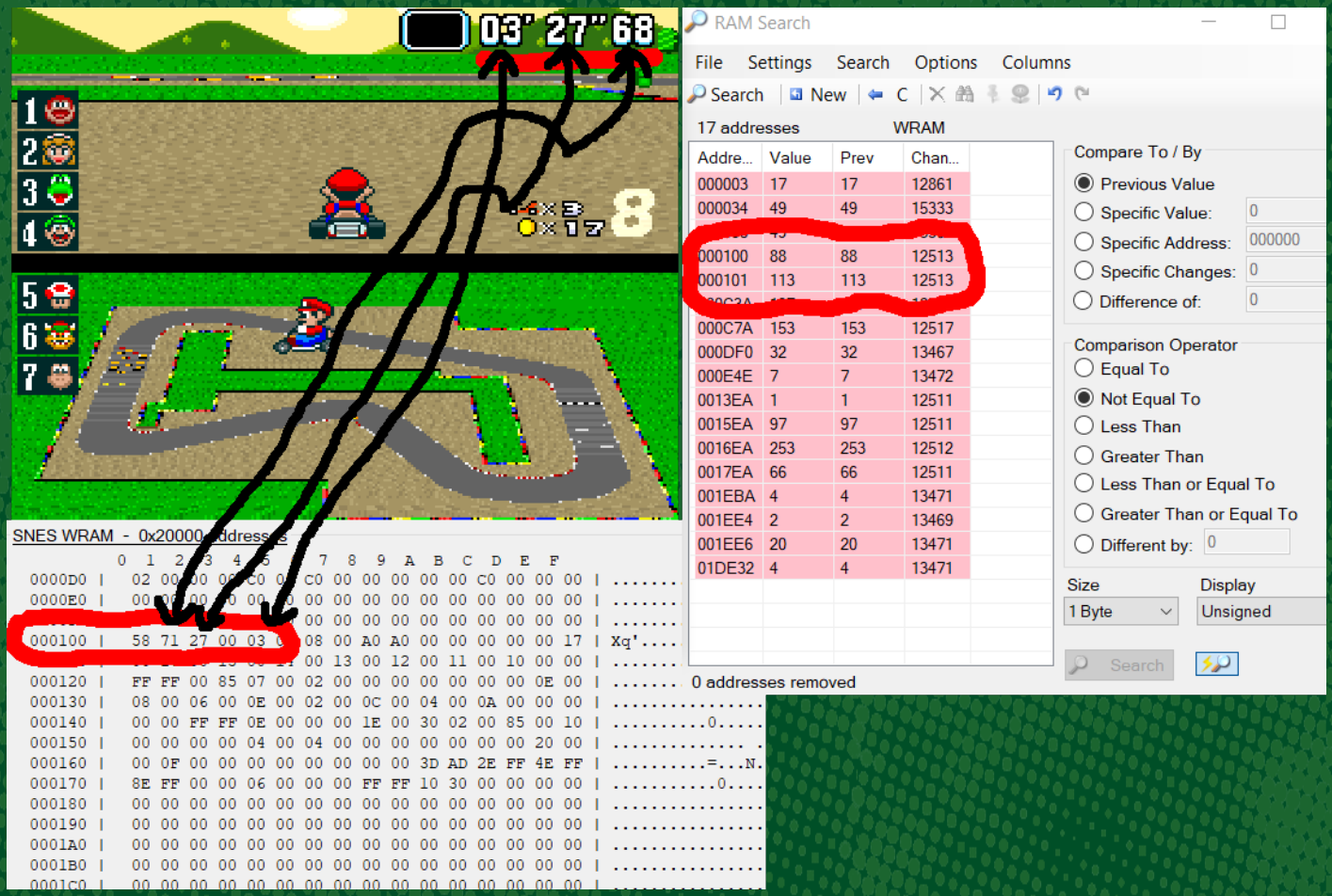

Integration

- Need to collect RAM values (used BizHawk).
- Convert Hex to decimal and add rambase number and integrate into scenario and data files

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{
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        },
        "lapsize": {
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            "type": "|u1"
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        "checkpoint": {
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            "type": "|u1"
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            "type": "|u1"
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        "minute": {
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            "type": "|u1"
        },
        "second": {
            "address": 8257794,
            "type": |u1"
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        }
    }
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{
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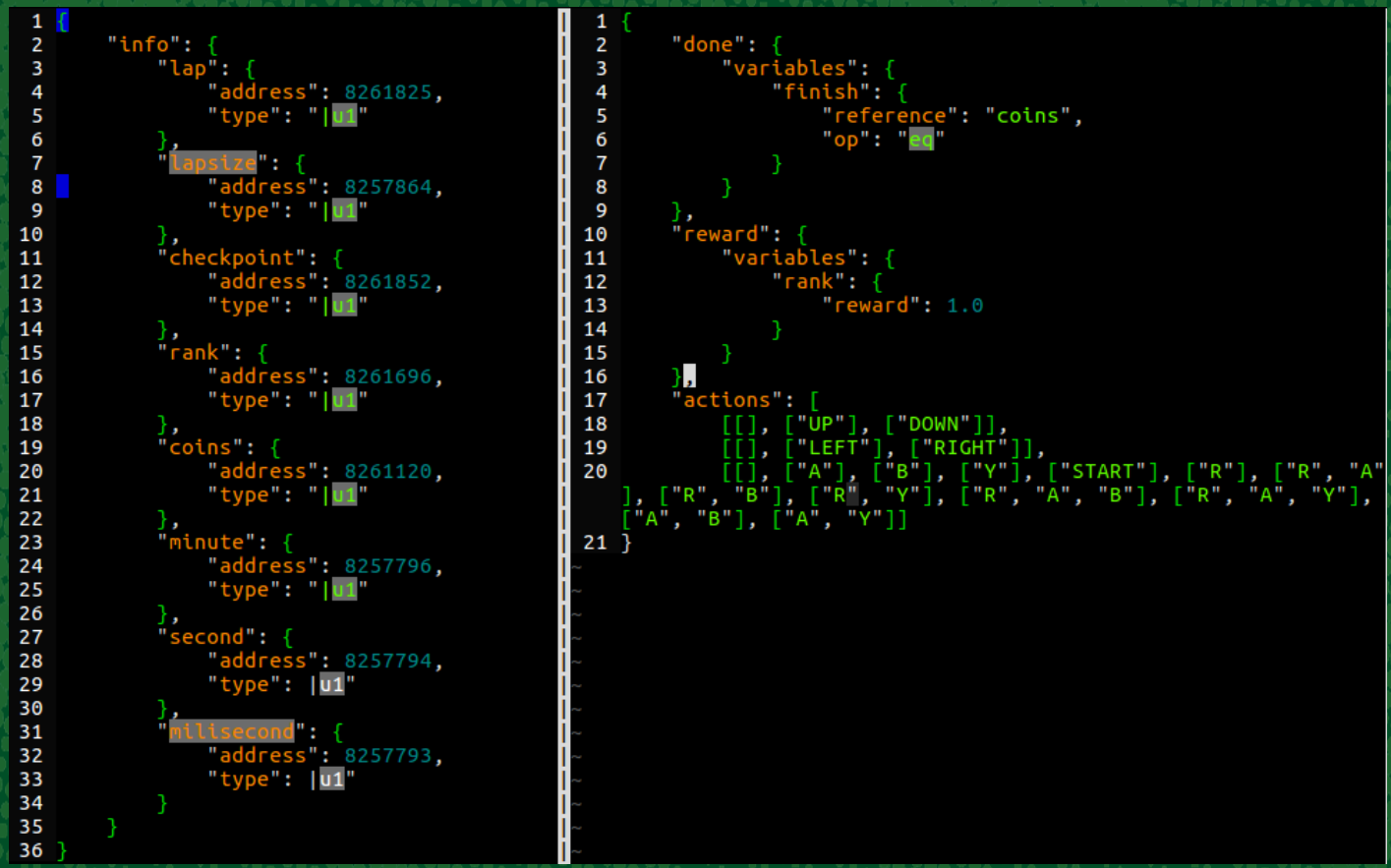
- Not all RAM values are so easy to get nor define. (Lua scripts)



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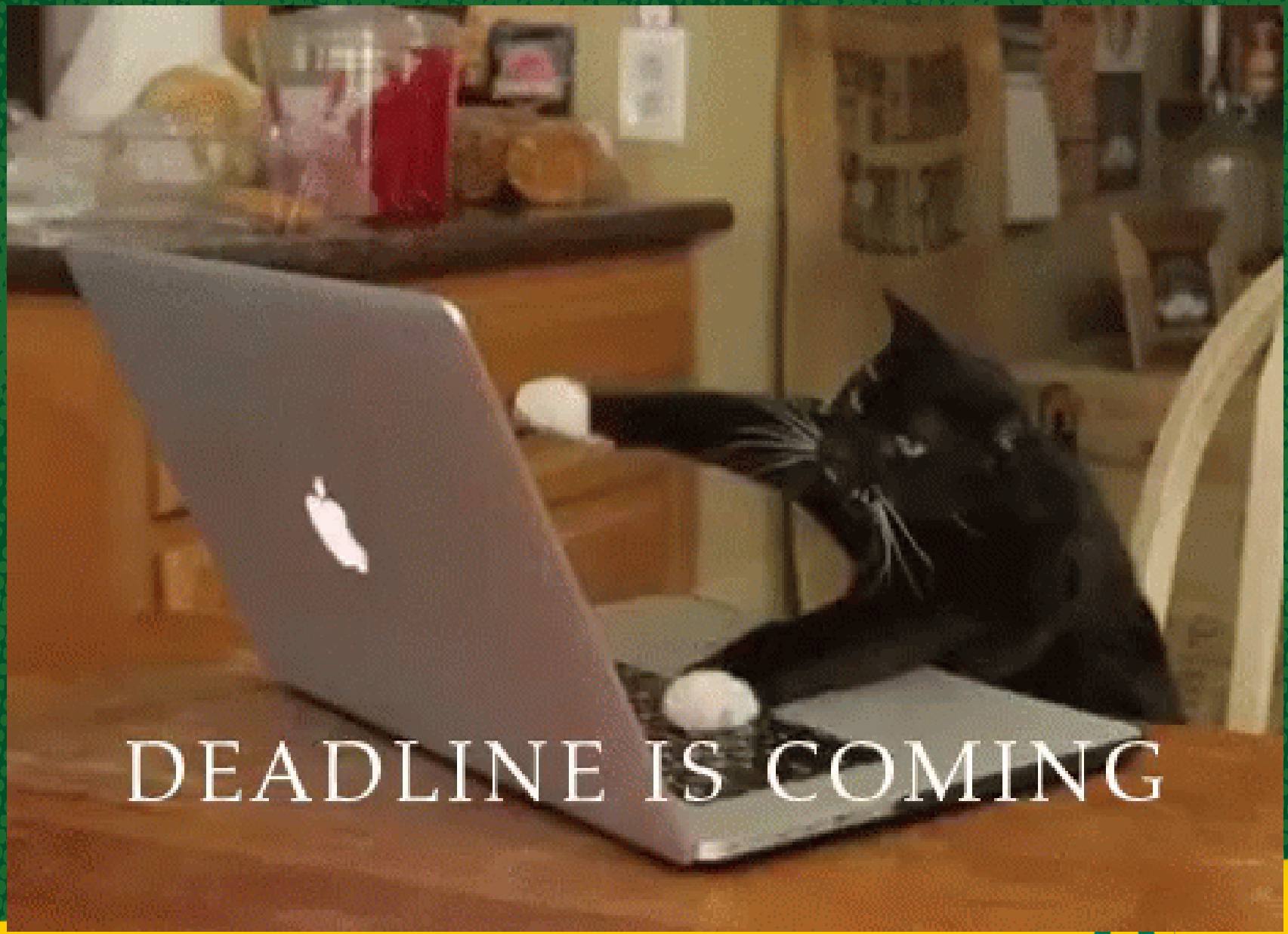
So Let's Make Something Work



So Let's Make Something Work

Goals

- Get a program to work nicely with retro
-