Math 305 Homework 5

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Problem 1

```
    % Initialize the game board
board = [0 0 0 0 0 9 0 9 0 -6 0 0 0 0 0 0 0 -6 0 0];

num_simulations = 500;
total = 0;

for i=1:num_simulations
% Initialize the player's position and turn counter
pos = 1;
num_turns = 0;

% Play the game until the player reaches square 20 (EXACTLY)
while pos < 20
    % Roll the die
    roll = randi(6);

    % Update the player's position based on the roll
    if roll == 1 || roll == 2
        % Do not move
    elseif roll == 3 || roll == 4
        pos = pos + 1;
    else
        pos = pos + 2;
    end

    % Reset player to square 19 if they roll a 2.
    if pos == 21
        pos = 19;
    end

    % Check for chutes and ladders
    if board(pos) ~= 0
        pos = pos + board(pos);
    end

    % Increment the turn counter
    num_turns = num_turns + 1;
end
game_lengths(i) = num_turns;
total = total + num_turns;
end
```

```
average = total / num_simulations;
```

2. Average of 500 games: 23.4260 turns.

3. Transition matrix:

```
P = zeros(20, 20);

% Roll a 1 or 2
P(1:20+1:end) = 1/3;

% Roll a 3 or 4
P(1:19, 2:20) = 1/3;
P(20, 20) = 1/3;

% Roll a 5 or 6
P(1:18, 3:20) = 1/3;
P(19, 20) = 1/6;
P(20, 20) = 1/3;

% Chutes and ladders
P(6, 15) = 1;
P(8, 17) = 1;
P(9, 3) = 1;
P(18, 12) = 1;
P(19, 20) = 1/3;
```

4.
   - As n increases, the probability of being on square 20 increases, and the probability of being on square 1 decreases.
   - The absorbing state is square 20 (but idk if that counts because the game instantly ends)
   - Minimum length is 6 turns, rolling 2,2,2,1,2,1.
   - The number of turns at which you'd be done 50% of the time is 9 turns.

     ```
             p50 = prctile(game_lengths, 50)

     ```

     I got around 9 on average.
   - The number of turns at which you'd be done 90% of the time is 24 turns.

     ```
         p90 = prctile(game_lengths, 90)

     ```