Week 2 Questions

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Question 1.

(a) 6 choices each time. If order of die rolls matters then $6^3 = 216$

(b) $5^3 = 125$ ways to not get a single 2. $216 - 125 = 91$ = number of events where atleast single 2. $\frac{91}{216} = .421$ percentage of where atleast one 2.

(c)

```
function out = tripleDieRoll(reps)
    out = simulation(reps);
end

function out = dieRoll(sides,reps)
    out  = randi([1 sides],1,reps);
end


function prob = simulation(reps)
    count = 0;
    for index = 1:reps
        currentRolls = dieRoll(6,3);
        for throwno = 1:3
            if currentRolls(throwno) == 2
                count = count + 1;
                break;
            end
        end
    end
    prob = (count/reps)*100;
end
```

call with tripleDieRoll(ARBIRTARY_NUMBER_OF_SIMULATIONS)
$42\% \pm 1\%$ with a number of 10 million simulations.

(d) $6 + 6 + 5 = 17$ which is the only way to actually. get 17 but also can be in any order so

$$\frac{3}{216} = 0.014$$

(e) Since purely a sum we don't really need to use conditional probability we can just consider 2 dice rolls that sum to $12 - 1 = 11$

$$\{6, 5\}, \{5, 6\}$$

$$\frac{2}{(6^2)} = 0.056$$

Question 2

(a) $\frac{1}{6}$ chance of a 5 if 6 sided and $\frac{1}{20}$ if 20 sided. $\frac{1}{6}$ chance of a 1 and $\frac{5}{6}$ chance of anything else in first throw.

$$\frac{1}{6} * \frac{1}{6} + \frac{5}{6} * \frac{1}{20} = .06894$$

(b) If 6 sided die then impossible hence

$$\frac{1}{6} * 0 + \frac{5}{6} * \frac{1}{20} = 0.0417$$

Question 3

P(E—F)*P(F) = P(F—E)*P(E)

Probability of brown hair P(F) = $.2 * .4 + .6 * 1 = 0.68$
Probability of being criminal given brown hair = ?
Probability of being criminal P(E) = .6
Probability of brown hair given criminal = 1

$$\frac{.6 * 1}{.68} = 0.882$$

Question 4

P(Observe—Location) = given
P(Location) = given
P(Location— Observe) = unknown
P(Observation) = 100% given infinite time
Assume that all prob stays constant till observation occurs and that all tiles have same P(Observation)

(P(O—L)*P(L))/P(O) = P(L—O)

answer =

```
0.0375    0.0950    0.0375    0.0025
```

```
0.0025    0.0750    0.0475    0.0375
0.0005    0.0025    0.0750    0.0475
0.0005    0.0005    0.0050    0.0375
```

```
function resGrid = cell_tracker(locGrid, obsGivenLocGrid)
    [rowLen,colLen] = size(locGrid);
    if [rowLen,colLen] ~= size(obsGivenLocGrid)
        error("grid dimensions are different");
    end
    resGrid = zeros(rowLen,colLen);
    for i = 1:rowLen
        for j = 1:colLen
            % probability of observation is taken to be 100%
            % We assume no probability changes in time until observat
            resGrid(i,j) = calcCondLocProb(locGrid(i,j), ...
                obsGivenLocGrid(i,j),1);
        end
    end
end

function res = calcCondLocProb(locProb,obsGivenLocProb,obsProb)
    res = (obsGivenLocProb*locProb)/obsProb;
end
```

Iterates over both grids and applies formula given above to both grids