

## Quiz 6

Game of craps:

If sum is:

- 2,3 shooter loses
- 11, 12 shooter wins
- $i, 4 \leq i \leq 10$  : wins if shooter makes same point;  
Loses if he gets 2, 3, 11, 12  
Repeat otherwise

a) What is the conditional probability that shooter gets 11 if he wins the first round?

$$p(\text{shooter gets 11} \mid \text{wins the first round}) = 2/3$$

b) Find probability of winning?

$$p(\text{win}) = p(\text{win} \mid 11, 12) p(11, 12) + p(\text{win} \mid i \text{ for } 4 \leq i \leq 10) p(i)$$

$$p(\text{win}) = 1(3/36) + p(\text{win} \mid i \text{ for } 4 \leq i \leq 10) p(i)$$

$$p(\text{win} \mid i) = \sum_{k=0}^{\infty} p(\text{not}(2, 3, 11, 12) \text{ and not}(i) \mid i)^k p(i) =$$

$$p(i) \cdot \frac{1}{1 - p(\text{not}(2, 3, 11, 12) \text{ and not}(i))} =$$

$$p(i) \cdot \frac{1}{p((2, 3, 11, 12) \text{ or } i)} =$$

$$p(i) \cdot \frac{1}{p(2, 3, 11, 12) + p(i)}$$

Hence,

$$p(\text{win}) = 1/12 + p(\text{win} \mid i) \cdot p(i) = 1/12 + \sum_{i=4}^{10} \frac{p(i) \cdot p(i)}{p(2, 3, 11, 12) + p(i)}$$

$$p(i) = \frac{6 - |i - 7|}{36}$$

i	4	5	6	7	8	9	10
p(i)	3/36	4/36	5/36	6/36	5/36	4/36	3/36
p(win i)	1/3	2/5	5/11	1/2	5/11	2/5	1/3
p(win i)p(i)	1/36	2/45	6/95	1/12	6/95	2/45	1/36

17/48

$$p(\text{win}) = 1/12 + 17/48 = 7/16 = 0.44$$