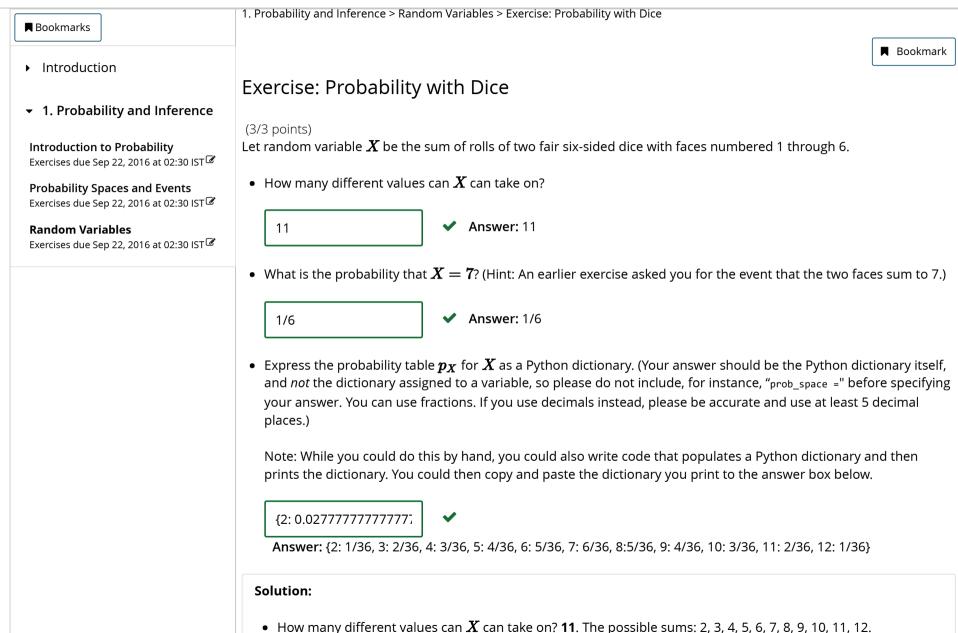


MITx: 6.008.1x Computational Probability and Inference



• What is the probability that X=7? (Hint: An earlier exercise asked you for the event that the two faces sum to 7.) **1/6**. Reasoning: We use the probability space from the two dice probability space exercise. Note that " X=7" corresponds to the event that the two rolls sum to 7 from a previous exercise: $\mathcal{A}_{\text{sum-to-7}}=\{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\}$. Then

$$\mathbb{P}(X=7) = \mathbb{P}(\mathcal{A}_{ ext{sum-to-7}})$$

$$= \qquad \mathbb{P}\big(\{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\}\big)$$

$$=\underbrace{\mathbb{P}\big((1,6)\big)}_{\frac{1}{36}} + \underbrace{\mathbb{P}\big((2,5)\big)}_{\frac{1}{36}} + \underbrace{\mathbb{P}\big((3,4)\big)}_{\frac{1}{36}} + \underbrace{\mathbb{P}\big((4,3)\big)}_{\frac{1}{36}} + \underbrace{\mathbb{P}\big((5,2)\big)}_{\frac{1}{36}} + \underbrace{\mathbb{P}\big((6,1)\big)}_{\frac{1}{36}} = \underbrace{\frac{6}{36}}_{\frac{1}{36}}$$

• Express the probability table p_X for X as a Python dictionary. (While you could do this by hand, you could also write code that populates a Python dictionary and then prints the dictionary. You could then copy and paste the dictionary you print to the answer box below.)

The pattern to notice is as follows:

There is 1 way to sum to 2: (1,1)

There are 2 ways to sum to 3: (1,2), (2,1)

There are 3 ways to sum to 4: (1,3), (2,2), (3,1)

There are 4 ways to sum to 5

5 ways to sum to 6

6 ways to sum tp 7

5 ways to sum to 8

4 ways to sum to 9

```
3 ways to sum to 10
2 ways to sum to 11
1 ways to sum to 12
```

Each of the possible outcomes is equally likely with probability 1/36. Thus: X=1 has 1 outcome associated with it (1,1): probability = 1/36 X=2 has 2 outcomes associated with it (1,2), (2,1): probability = 2/36 And so forth.

Thus, the answer is: **{2: 1/36, 3: 2/36, 4: 3/36, 5: 4/36, 6: 5/36, 7: 6/36, 8:5/36, 9: 4/36, 10: 3/36, 11: 2/36, 12: 1/36}**

If you went the coding route, here's a way to build up the probability table/PMF:

```
pmf = {} # start with empty pmf
for x in range(1, 7):
    for y in range(1, 7):
        if (x+y) in pmf:
            pmf[x+y] += 1/36
        else:
            pmf[x+y] = 1/36
```

You can then print out the PMF, copy, and paste to the answer box.

You have used 1 of 5 submissions

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