Prob Review Lab Write-up

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Part 1

Output of test_part1.py

```
test/test_part1.py::TestFunctionEvaluatePMF::test_throws_when_probabilities_do_not
_sum_to_one PASSED
[  6%]
test/test_part1.py::TestFunctionEvaluatePMF::test_throws_when_passed_negatively_li
kely_outcomes PASSED
[ 13%]
test/test_part1.py::TestFunctionEvaluatePMF::test_correct_for_two_dice_sum PASSED
[ 20%]
test/test_part1.py::TestFunctionEvaluatePMF::test_correct_for_two_dice_diff PASSED
[ 26%]
test/test_part1.py::TestFunctionEvaluatePMF::test_correct_for_rolling_doubles
PASSED
[ 33%]
test/test_part1.py::TestFunctionExpectedValue::test_throws_when_probabilities_do_n
ot_sum_to_one PASSED
[ 40%]
test/test_part1.py::TestFunctionExpectedValue::test_throws_when_passed_negatively_
likely_outcomes PASSED
[ 46%]
test/test_part1.py::TestFunctionExpectedValue::test_throws_when_passed_empty_pmf
PASSED
[ 53%]
test/test_part1.py::TestFunctionExpectedValue::test_correct_for_two_dice_sum
PASSED
[ 60%]
test/test_part1.py::TestFunctionExpectedValue::test_correct_for_two_dice_diff
PASSED
[ 66%]
test/test_part1.py::TestFunctionVariance::test_throws_when_probabilities_do_not_su
m_to_one PASSED
[ 73%]
test/test_part1.py::TestFunctionVariance::test_throws_when_passed_negatively_likel
y_outcomes PASSED
[ 80%]
test/test_part1.py::TestFunctionVariance::test_throws_when_passed_empty_pmf PASSED
[ 86%]
test/test_part1.py::TestFunctionVariance::test_correct_for_two_dice_sum PASSED
[ 93%]
test/test_part1.py::TestFunctionVariance::test_correct_for_two_dice_diff PASSED
[100%]
```

1.4 Wrap Up

- Why does the PMF for the sum of two dice look the way it does? Can you explain why a value of 7 is more likely than a value of 10?
    - The PMF for the sum of two dice look the way it does because the likelihood of getting a number in the middle is higher than a low number or a high number. In the case of two six-sided dice, a value of 7 is more likely than a value of 10. The reason why is because there are more combinations of (1 to 6) + (1 to 6) that adds up to 7 than there are that adds up to 10.
        - 10: 4+6, 5+5
        - 7: 1+6, 2+5, 3+4

Part 2

Output of test_part2.py

```
test/test_part2.py::TestFunctionEvaluateJointPMF::test_throws_when_probabilities_d
o_not_sum_to_one PASSED
[  5%]
test/test_part2.py::TestFunctionEvaluateJointPMF::test_throws_when_passed_negative
ly_likely_outcomes PASSED
[ 11%]
test/test_part2.py::TestFunctionEvaluateJointPMF::test_correct_for_two_dice_sum_an
d_two_dice_difference PASSED
[ 17%]
test/test_part2.py::TestFunctionEvaluateJointPMF::test_correct_for_two_dice_sum_an
d_two_dice_sum_plus_one PASSED
[ 23%]
test/test_part2.py::TestFunctionEvaluateJointPMF::test_correct_for_two_dice_sum_an
d_weighted_two_dice_sum PASSED
[ 29%]
test/test_part2.py::TestFunctionExpectedValue::test_throws_when_probabilities_do_n
ot_sum_to_one PASSED
[ 35%]
test/test_part2.py::TestFunctionExpectedValue::test_throws_when_passed_negatively_
likely_outcomes PASSED
[ 41%]
test/test_part2.py::TestFunctionExpectedValue::test_throws_when_passed_empty_pmf
PASSED
[ 47%]
test/test_part2.py::TestFunctionExpectedValue::test_correct_for_two_dice_sum_and_t
wo_dice_difference PASSED
[ 52%]
test/test_part2.py::TestFunctionExpectedValue::test_correct_for_two_dice_sum_and_t
wo_dice_sum_plus_one PASSED
[ 58%]
test/test_part2.py::TestFunctionExpectedValue::test_correct_for_two_dice_sum_and_w
eighted_two_dice_sum PASSED
[ 64%]
test/test_part2.py::TestFunctionCovariance::test_throws_when_probabilities_do_not_
sum_to_one PASSED
```

```
[ 70%]
test/test_part2.py::TestFunctionCovariance::test_throws_when_passed_negatively_lik
ely_outcomes PASSED
[ 76%]
test/test_part2.py::TestFunctionCovariance::test_throws_when_passed_empty_pmf
PASSED
[ 82%]
test/test_part2.py::TestFunctionCovariance::test_correct_for_two_dice_sum_and_two_
dice_difference PASSED
[ 88%]
test/test_part2.py::TestFunctionCovariance::test_correct_for_two_dice_sum_and_two_
dice_sum_plus_one PASSED
[ 94%]
test/test_part2.py::TestFunctionCovariance::test_correct_for_two_dice_sum_and_weig
hted_two_dice_sum PASSED
[100%]
```

2.2.3 Wrap Up

For each pair of jointly distributed random variables, are the two variables correlated with one another? How do you know? Does this make sense?

- The pair of jointly distributed random variables are correlated with one another, except for joint of sum/diff, which has a cross covariance / correlation of 0. This makes sense because sum and diff are independent functions with no correlation to each other. They are both dependent on the dice rolls, not each other. Whereas the other two joint functions have some sort of dependence. sum_plus_one, for example, depends on the output of sum.

Part 3

Output of test_part3.py

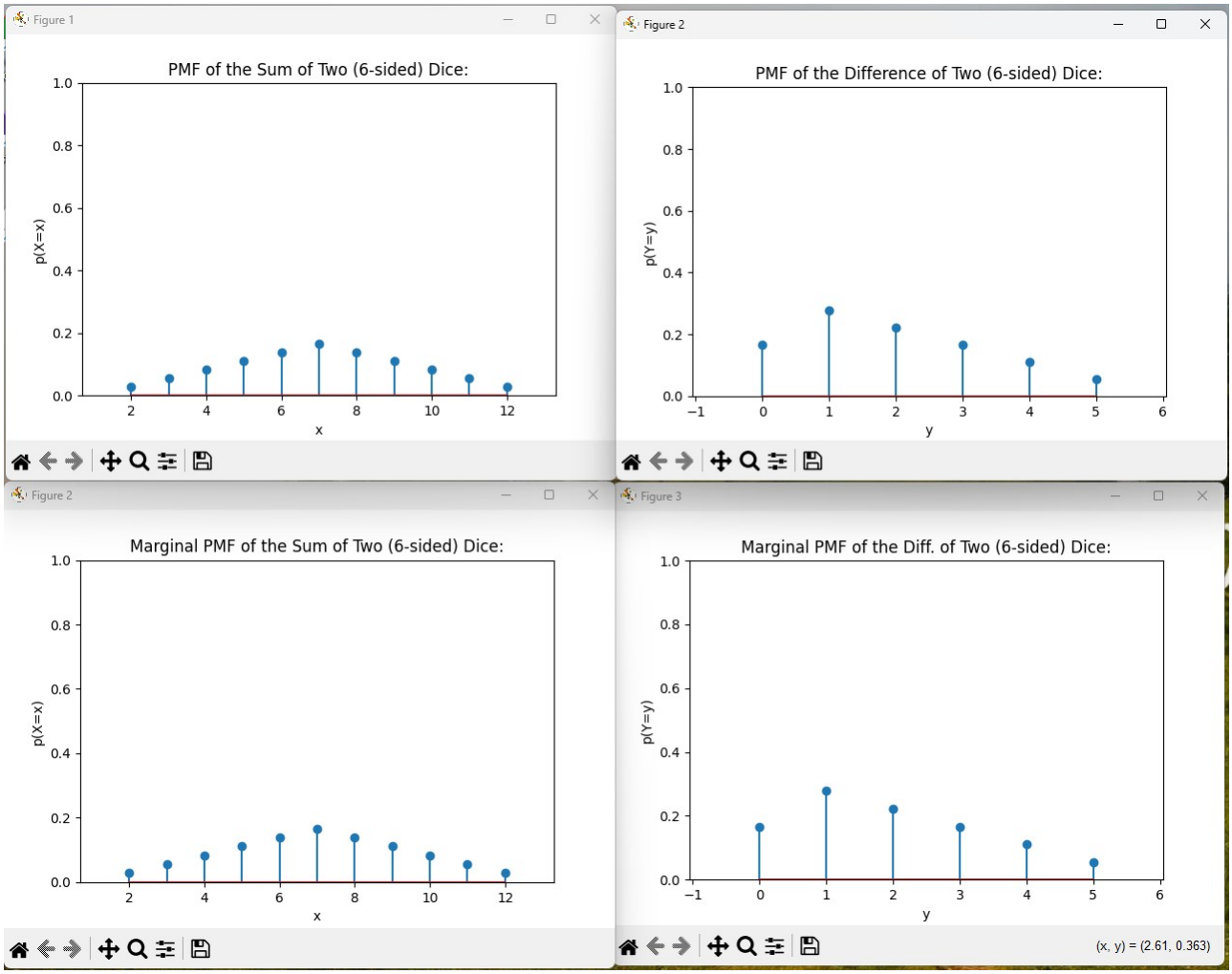
```
test/test_part3.py::TestFunctionMarginalizeOut::test_throws_when_invalid_indicator
_passed_in PASSED
[ 12%]
test/test_part3.py::TestFunctionMarginalizeOut::test_throws_when_invalid_joint_pmf
_received PASSED
[ 25%]
test/test_part3.py::TestFunctionMarginalizeOut::test_correct_for_marginalize_out_d
ifference_from_sum_and_difference PASSED
[ 37%]
test/test_part3.py::TestFunctionMarginalizeOut::test_correct_for_marginalize_out_s
um_from_sum_and_difference PASSED
[ 50%]
test/test_part3.py::TestFunctionConditionAgainst::test_throws_when_invalid_indicat
or_passed_in PASSED
[ 62%]
test/test_part3.py::TestFunctionConditionAgainst::test_throws_when_invalid_joint_p
mf_received PASSED
```

```
[ 75%]
test/test_part3.py::TestFunctionConditionAgainst::test_correct_for_condition_again
st_difference_from_sum_and_difference PASSED
[ 87%]
test/test_part3.py::TestFunctionConditionAgainst::test_correct_for_condition_again
st_sum_from_sum_and_difference PASSED
[100%]
```

3.2.1 Wrap Up

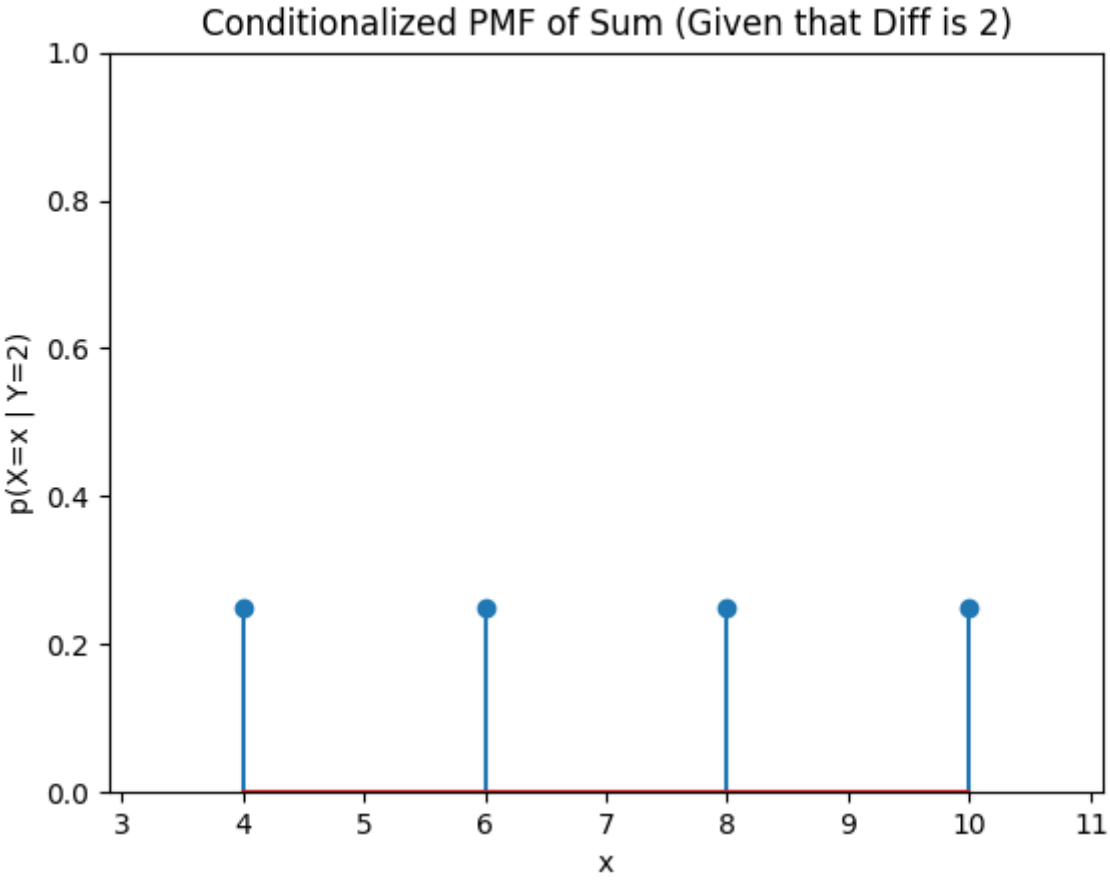
Do the marginal PMFs match the PMFs you generated in part 1?

- Yes



Please describe the output of the conditional PMFs. Why does the output make sense?

- The output of the conditional PMFs are the probability of the unknown variable being a certain value, given that the known value equal something. The output makes better sense when we look at a picture of it.



- This is saying that if Y=2 in the joint PMF, then the chances of x being 4, 6, 8, or 10 are equal.