

## Feedback — Homework 4

[Help Center](#)

Thank you. Your submission for this homework was received.

You submitted this homework on Thu 4 Feb 2016 3:46 AM PST. You got a score of 97.00 out of 100.00.

*"Invention consists in avoiding the constructing of useless contraptions and in constructing the useful combinations which are in infinite minority", Henri Poincare*

### Combinatorics

In this week's material, we will create enumerations, permutations and combinations of items from a set of outcomes. We will then consider sequences of repeated trials that are modeled by these objects. These problems will form our preparation for this week's mini-project on *Yahtzee*.

#### Question 1

##### Enumeration

Given the set of outcomes corresponding to a coin flip,  $\{Heads, Tails\}$ , how many sequences of outcomes of length five (repetition allowed) are possible?

You entered:

Your Answer		Score	Explanation
32	✓	10.00	Correct. $2^5 = 32$ .
Total		10.00 / 10.00	

#### Question 2

##### Probability for sequences of trials

Consider a sequence of trials in which a fair four-sided die (with faces numbered 1-4) is rolled twice. What is the expected value of the product of the two die rolls? Enter the answer as a floating point number below.

You entered:

6.25

Your Answer		Score	Explanation
6.25	✓	10.00	Correct.
Total		10.00 / 10.00	

#### Question Explanation

Remember that there are sixteen possible pairs of die values, each with probability  $\frac{1}{16}$ .

## Question 3

Given a trial in which a decimal digit is selected from the list ["0", "1", "2", "3", "4", "5", "6", "7", "8", "9"] with equal probability **0.1**, consider a five-digit string created by a sequence of such trials (leading zeros and repeated digits are allowed). What is the probability that this five-digit string consists of five consecutive digits in either ascending or descending order (e.g; "34567" or "43210") ?

Enter your answer as a floating point number with at least four significant digits of precision.

You entered:

0.00012

Your Answer		Score	Explanation
0.00012	✓	10.00	Correct. Each outcome has probability <b>0.00001</b> . There are six strings with consecutive ascending digits and six string with consecutive descending digits. Therefore, the probability of this event is <b>0.00012</b> .
Total		10.00 / 10.00	

## Question Explanation

Remember that the probability of event is the sum of the probabilities associated with each of its outcomes.

## Question 4

### Permutations

Consider a trial in which five digit strings are formed as permutations of the digits ["0", "1", "2", "3", "4", "5", "6", "7", "8", "9"]. (In this case, repetition of digits is not allowed.) If the probability of each permutation is the same, what is the probability that this five digits string consists of consecutive digits in either ascending or descending order (e.g; "34567" or "43210")? Enter your answer as a floating point number with at least four significant digits of precision.

You entered:

0.0003968

Your Answer	Score	Explanation
0.0003968 ✓	10.00	Correct. There are 12 possible permutations out of $\frac{10!}{5!}$ permutations that are either ascending or descending.
Total	10.00 / 10.00	

## Question 5

In this week's lectures, we discussed an iterative approach to generating [all sequences of outcomes](#) where repeated outcomes were allowed. Starting from this [program template](#), implement a function `gen_permutations(outcomes, num_trials)` that takes a list of outcomes and a number of trials and returns a set of all possible permutations of length `num_trials` (encoded as tuples) from this list of outcomes.

Hint: `gen_permutations` can be built from `gen_all_sequences` by adding a single `if`

statement that prevents repeated outcomes. When you believe that your code works correctly, select the answer printed at the bottom of the console.

Your Answer	Score	Explanation
<input type="radio"/> ('f', 'a', 'b', 'c')		
<input type="radio"/> ('a', 'f', 'b', 'e')		
<input checked="" type="radio"/> ('b', 'e', 'c', 'd')	✓ 10.00	Correct.
<input type="radio"/> ('e', 'b', 'd', 'c')		
Total	10.00 / 10.00	

## Question 6

### Subsets

A set  $S$  is a *subset* of another set  $T$  (mathematically denoted as  $S \subseteq T$ ) if every element  $x$  in  $S$  (mathematically denoted as  $x \in S$ ) is also a member of  $T$ . Which of the following sets are subsets of the set  $\{1, 2\}$ ?

Your Answer	Score	Explanation
<input checked="" type="checkbox"/> $\{\}$	✓ 2.00	The empty set is a subset of any set.
<input type="checkbox"/> $\{1, 2, 3, 4\}$	✓ 2.00	The elements <b>3</b> and <b>4</b> are not members of $\{1, 2\}$
<input type="checkbox"/> $\{3, 4\}$	✓ 2.00	The elements <b>3</b> and <b>4</b> are not members of $\{1, 2\}$
<input checked="" type="checkbox"/> $\{1, 2\}$	✓ 2.00	A set is always a subset of itself.
<input checked="" type="checkbox"/> $\{1\}$	✓ 2.00	
Total	10.00 / 10.00	

## Question 7

If the set  $T$  has  $n$  members, how many distinct sets  $S$  are subsets of  $T$ ? You may want to figure out the answer for a few specific values of  $n$  first. Enter the answer below as a math expression in  $n$ .

You entered:

 $2^n$ 

Preview

[Help](#)

Your Answer		Score	Explanation
$2^n$	✓	10.00	Correct.
Total		10.00 / 10.00	

## Question Explanation

Remember to include the empty set and the set itself in your count.

## Question 8

## Combinations

Given a standard 52 card deck of playing cards, what is the probability of being dealt a five card hand where all five cards are of the same suit?

Hint: Use the formula for combinations to compute the number of possible five card hands when the choice of cards is restricted to a single suit versus when the choice of cards is unrestricted.

Compute your answer in Python using `math.factorial` and enter the answer below as a floating point number with at least four significant digits of precision.

You entered:

0.0019807923169267707

Your Answer		Score	Explanation
0.0019807923169267707	✓	10.00	Correct. There are $\frac{13!}{5!8!}$ possible hands with 5 cards in a single suit. Multiply this value by the number of suits and divide by the $\frac{52!}{5!47!}$ possible hands.
Total		10.00 / 10.00	

## Question Explanation

Remember to account for the fact that there are four possible suits.

## Question 9

**Pascal's triangle** is a triangular array of numbers in which the entry on one row of the triangle corresponds to the sum of the two entries directly above the entry. [This program](#) prints out the first few rows of Pascal's triangle.

Enter a math expression in  $m$  and  $n$  using factorial (!) that represents the value of the  $n$ th entry of the  $m$ th row of Pascal's triangle. (Both the row numbers and entry numbers are indexed starting at zero.)

You entered:

$m!/(n!(m-n)!)$

Preview

[Help](#)

Your Answer	Score	Explanation
$m!/(n!(m-n)!)$	✓ 10.00	Correct. The $n$ th entry of the $m$ th row is the number of combinations of $m$ items chosen $n$ at a time.
Total	10.00 / 10.00	

## Question 10

### Testing

For the final question of this week's homework, your task is to create a list of test cases for the `merge()` function from the [week 1 mini-project](#). Each of the test cases should be a list of integers of length at most length 10 where each integer is either zero or 2 raised to a positive power. You may provide at most 10 test cases.

This [OwlTest](#) will run the submitted test cases against a suite of erroneous implementations of `merge()` and compare results versus those computed by our reference implementation. Once OwlTest has successfully assessed your test cases, you

will see the message `TEST CASES successfully assessed.`. Following this message is a seven-digit number that you should enter in the form below. If your score on the problem is less than 10 points, OwlTest also outputs an example of one erroneous program that passes all of your submitted test cases.

Note that this question is essentially a simplified version of this [Practice Activity](#) from week 2. If you have completed this challenge, you are welcome to use the test cases that you derived for this question. If you have not complete this activity, you are welcome to review the various threads in the discussion forum on this activity. However, note that we have redacted any instances where specific lists of tests cases for `merge()` were posted in the forums.

You entered:

Your Answer	Score	Explanation
3036001	✓ 7.00	Your code was valid. Add/improve your tests to get a better score.
Total	7.00 / 10.00	