Feedback — Homework 4

Help Center

You submitted this homework on **Wed 24 Jun 2015 2:33 AM PDT**. You got a score of **90.00** out of **100.00**. You can attempt again, if you'd like.

"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, permuttations 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:

32

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

Question 2

How many sequences of length four can be formed by choosing the first two elements in the

sequences from a set of outcomes of size x and the last two elements in the sequences from a set of outcomes of size y? In this case, repeated outcomes are allowed.

Enter a math expression in x and y for the number of possible sequences of outcomes below.

You entered:

x*x*y*y

Preview Help

Your Answer		Score	Explanation
x*x*y*y	✔	10.00	Correct. There are x^2 possible choices for the first two outcomes and y^2 possible choice for the last two outcomes.
Total		10.00 / 10.00	

Question 3

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 4

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 0.00001. There are six strings with consecutive ascending digits and six string with consecutive descending digits. Therefore, the probability of this event is 0.00012.
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 5

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:

0.00039682539

Your Answer		Score	Explanation
0.00039682539	✔	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 6

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 list of all possible permutations of length `num_trials` from this set 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
['e', 'b', 'd', 'c']			
['a', 'f', 'b', 'e']	✖	0.00	Incorrect.
['f', 'a', 'b', 'c']			

['b', 'e', 'c', 'd']

Total	0.00 / 10.00

Question 7

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
☐ $\{1, 2, 3, 4\}$	✔	2.00	The elements 3 and 4 are not members of $\{1, 2\}$
☐ $\{3, 4\}$	✔	2.00	The elements 3 and 4 are not members of $\{1, 2\}$
☑ $\{1\}$	✔	2.00	
☑ $\{1, 2\}$	✔	2.00	A set is always a subset of itself.
☑ $\{\}$	✔	2.00	The empty set is a subset of any set.
Total		10.00 / 10.00	

Question 8

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 9

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:

```
0.00198079231
```

Your Answer		Score	Explanation
0.00198079231	✔	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 10

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 nth entry of the mth 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 nth entry of the mth row is the number of combinations of m items chosen n at a time.
Total		10.00 / 10.00	