Math 3336

Homework Assignment 8

Instructions

- Record your answers to the following 10 questions. Show your work when a question requires you to do so.
- Scan your work and save the file as a .pdf (make sure your work and answers are legible)
- Upload your scanned work to CASA CourseWare using the "Assignments" tab. (Click this link for instructions on how to do this).
- Homework submitted after 11:59pm on the indicated due date will be assigned a grade of 0.
- Also, **DON'T FORGET THAT** $0 \in \mathbb{N}$.
- I understand that if any of the questions from this assignment (or future ones) are shared in ways that violate our Academic Honesty Policy, then the syllabus will change. Specificlaly, Homework and Quizzes will be worth zero points.

  Name:

  Signature:

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1. (10 points) There are ten MC questions on this homework, and each question features 5 answer choices. How many different ways are there to answer all of the questions on this assignment?

(a) 5^{10}

(b) 0

(c) 1

(d) -1

(e) All of the above

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2. (10 points) How many different ways can a logical operator between two statements, P and Q be defined? (Hint: think about making your own symbol – something silly or random like $P\heartsuit Q$ – and then counting how many different ways there are to fill out its truth table.)

P	Q	$P\heartsuit Q$
T	T	
T	F	
F	T	
F	F	

(a) $2^4 = 16$

(b) 0

(c) 1

(d) -1

(e) None of the above.

3. (10 points) There are 140 students in our class (woah!). Suppose we want to create a subset of 30 of these students. How many different such subsets could we create?

(a) $\binom{140}{30}$

(b) 140

(c) 30

(d) 0

(e) None of the above.

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4. (10 points) The expression $n!$ ...

(a) All of the below.

(b) equals $n(n-1)(n-2)\cdots 2 \cdot 1$

(c) equals $n \cdot (n-1)!$ (for all $n \geq 1$)

(d) equals the number of length-n lists that can be made using n symbols.

(e) appears as the numerator in the formula defining $\begin{pmatrix} n \\ k \end{pmatrix}$ (where $k < n$)

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5. (10 points) For this question let $k, n \in \mathbb{N}$ with $k < n$. The expression $\begin{pmatrix} n \\ k \end{pmatrix}$ can be computed using the formula

(a) $\dfrac{n!}{k!(n-k)!}$

(b) 0

(c) -1

(d) ice cream

(e) None of the above

6. (10 points) The Inclusion-Exclusion Principle is a statement about sets (that we use for some counting arguments); identify the principle fromm the options below.

(a) $|A \cup B| = |A| + |B| - |A \cap B|$

(b) $|A \cup B| =$ bananas

(c) $|A \cup B| = |A| +$ candy

(d) $|A \cup B| = -1$

(e) None of the above

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7. (10 points) According to the Pigeonhole Principle, if we have k objects being placed into n boxes and $k > n$, then...

(a) at least one box contains 1 or more objects

(b) all boxes are empty

(c) at least one box is empty

(d) at least one object is in two different boxes

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8. (10 points) Mathematicians and Computer Scientists will sometimes define sequences $\{a_n\}$ in order to...

(a) count interesting things (like the number of steps an algorithm needs)

(b) discover the best recipe for breakfast tacos

(c) complete their collection of the infinity stones

(d) bore their students to sleep

(e) None of the above

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9. (10 points) The characteristic polynomial for the second-order, linear, homogeneous recurrence equation

$$a_n = 3a_{n-1} - 2a_{n-2}$$

is...

(a) $x^2 - 3x + 2$

(b) 0

(c) x

(d) $-x$

(e) None of the above

10. (10 points) Consider the second-order, linear, homogeneous recurrence equation used in the previous problem, only now suppose it has initial conditions $a_0 = 2$ and $a_1 = 4$. By solving the characteristic equation, we know a closed-form solution is given by

$$a_n = \alpha(1)^n + \beta(2)^n = \alpha + \beta\, 2^n$$

To determine the values of α and β, we should...

(a) Use the initial conditions to set up a system of 2 equations involving the 2 unknowns α and β, and then solve.

(b) Look up the answer on Chegg.

(c) Pay Casey thousands of dollars in LEGO gift cards to get an answer from him.

(d) Pray to the Campus Squirrel Demi-Gods for guidance

(e) None of the above