

# Midterm 1

Started: Sep 23 at 10:56am

## Quiz Instructions

Please answer all questions. Good luck!

**NOTE:** in some answers, the symbol  $\wedge$  is used to indicate power. For example  $2^3 = 8$ .

### Question 1

1 pts

Let

$m$  = "Juan is a math major,"

$c$  = "Juan is a computer science major,"

$g$  = "Juan's girlfriend is a literature major,"

$h$  = "Juan's girlfriend has read Hamlet," and

$t$  = "Juan's girlfriend has read The Tempest."

Which of the following expresses the statement "Juan is a computer science major and a math major, but his girlfriend is a literature major who hasn't read both The Tempest and Hamlet."

(in this problem  $\wedge$  is **and**,  $\vee$  is **or**,  $\sim$  is **negation**).

☐  $c \wedge m \wedge g \wedge (\sim h \vee \sim t)$

☐  $c \wedge m \wedge g \wedge (\sim h \wedge \sim t)$

☐  $c \wedge m \wedge (g \vee (\sim h \vee \sim t))$

☐  $c \wedge m \wedge (g \vee (\sim h \wedge \sim t))$

☒  $c \wedge m \wedge g \wedge (h \vee t)$

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### Question 2

1 pts

The function  $((p \vee (r \vee q)) \wedge \sim(\sim q \wedge \sim r))$  is equal to the function

- ☐  $((p \vee r) \vee q) \wedge (p \vee r)$
- ☐  $(p \wedge r) \vee (p \wedge q)$
- ☐  $(p \vee q) \wedge \sim(p \vee r)$
- ☐  $(p \wedge q) \vee (p \wedge r)$
- ☐  $q \vee r$

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### Question 3

1 pts

The Boolean function  $[\sim(\sim p \wedge q) \wedge \sim(\sim p \wedge \sim q)] \vee (p \wedge r)$  is equal to the Boolean function

☒  $p \vee q$ ☐  $r$ ☐  $q$ ☐  $p$ ☐  $p \wedge r$ 

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### Question 4

1 pts

Consider the statement, "Either  $-2 \leq x \leq -1$  or  $1 \leq x \leq 2$ ." The negation of this statement is

- ☐  $x < -2$  or  $2 < x$
- ☐  $x \leq -2$  or  $2 \leq x$  or  $-1 < x < 1$
- ☐  $-1 < x < 1$
- ☐  $-2 < x < 2$
- ☒  $x < -2$  or  $2 < x$  or  $-1 < x < 1$

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 5

1 pts

Which of the following is a negation for “For any integer  $n$ , if  $n$  is composite, then  $n$  is even or  $n > 2$ .”

- ☐ There exists an integer  $n$  such that  $n$  is composite and  $n$  is even and  $n \leq 2$ .
- ☐ For any integer  $n$ , if  $n$  is composite, then  $n$  is not even or  $n \leq 2$ .
- ☐ For any integer  $n$ , if  $n$  is not composite, then  $n$  is even and  $n \leq 2$ .
- ☐ For any integer  $n$ , if  $n$  is not composite, then  $n$  is not even and  $n \leq 2$ .
- ☒ There exists an integer  $n$  such that  $n$  is composite and  $n$  is not even and  $n \leq 2$ .
- ☐ There exists an integer  $n$  such that if  $n$  is not composite, then  $n$  is not even and  $n \leq 2$ .
- ☐ For any integer  $n$ , if  $n$  is not composite, then  $n$  is not even or  $n \leq 2$ .
- ☐ There exists an integer  $n$  such that if  $n$  is composite, then  $n$  is not even and  $n \leq 2$ .
- ☐ For any integer  $n$ , if  $n$  is not composite, then  $n$  is not even and  $n \leq 2$ .
- ☐ There exists an integer  $n$  such that if  $n$  is not composite, then  $n$  is not even or  $n \leq 2$ .

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**NOTE:** in some answers, the symbol ^ is used to indicate power. For example  $2^3 = 8$ .

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### Question 6

1 pts

The product of any two irrational numbers is irrational.

- ☒ The statement is false.
- ☐ The statement is true.

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**NOTE:** in some answers, the symbol ^ is used to indicate power. For example  $2^3 = 8$ .

### Question 8

1 pts

The simplification of  $7^n + 2 \cdot 7^{n-1} + \dots + 2 \cdot 7^2 + 2 \cdot 7 + 2$  is

- ☒  $7^{2.5}$
- ☐  $(4 \cdot (7^n) - 1) / 3$
- ☐  $(3 \cdot 7^{(n+1)} - 1) / 2$
- ☐  $(2 \cdot 7^{(n+1)} - 1) / 3$

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## Quiz Instructions

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 9

1 pts

Define a function  $f: \mathbf{R} - \{0\} \rightarrow \mathbf{R}$  by the formula  $f(x) = (x + 3)/x$  for all nonzero real numbers  $x$ .

- ☐  $f$  is neither one-to-one, nor onto function.
- ☐  $f$  is only one-to-one function.
- ☐  $f$  violates the function definition.
- ☐  $f$  is only onto function.
- ☒  $f$  is both one-to-one and onto function.

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 10

1 pts

Let  $S$  be the set of all strings of 0's and 1's of length 3. Define a relation  $R$  on  $S$  as follows: for all strings  $s$  and  $t$  in  $S$ ,

$s R t \iff$  the two leftmost characters of  $s$  are the same as the two leftmost characters of  $t$ .

☐  $R$  is not an equivalence relation.

☐  $R$  is only transitive.

☐  $R$  is only reflexive.

☐  $R$  is only symmetric.

☒  $R$  is an equivalent relation.

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### Question 11

1 pts

A teacher offers ten possible assignments for extra credit in a course but requires students to choose them, without looking, from a hat. Six assignments involve library research and four are computer programming exercises. Suppose that a student chooses two assignments, one after the other, at random without replacement. What is the probability that at least one of the assignments is a computer programming exercise?

☐ 33.7%☐ 13.3%☐ 66.7%☐ 47.3%[Next ▶](#)

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 12

1 pts

A screening test for a certain disease is used in a large population of people of whom 1 in 1000 actually has the disease. Suppose that the false positive rate is 1% and the false-negative rate is 0.5%. Thus a person who has the disease tests positive for it 99.5% of the time, and a person who does not have the disease tests negative for it 99% of the time. What is the probability that a randomly chosen person who tests positive for the disease actually has the disease?

- ☐ 6.5%
- ☐ 2.8%
- ☐ 0.005%
- ☐ 9%

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### Question 13

1 pts

A certain connected graph has 68 vertices and 72 edges.

- ☐ The graph cannot have more edges than vertices.
- ☐ The graph is a tree.
- ☐ The graph is a tree with some vertices having loops.
- ☐ The graph has a circuit

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 14

1 pts

Suppose that a fair coin is tossed ten times.

(a) How many ways can at least eight heads be obtained?

(b) What is the probability of obtaining at least eight heads?

☐ 8 and 4.5%

☐ 56 and 5.5%

☐ 27 and 2.6%

☐ 27 and 2.7%

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**NOTE:** in some answers, the symbol ^ is used to indicate power. For example  $2^3 = 8$ .

### Question 15

1 pts

Use iteration to find an explicit formula for the following recursively defined sequence.

$$C_1 = 1 \quad \text{and} \quad C_k = 3C_{k-1} + 1 \quad \text{for } k \geq 2$$

☐  $(2^n + 1)/3$

☐  $(3n + 3)/6$

☐  $n^5$

☐  $(3^n - 1)/2$

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**NOTE:** in some answers, the symbol ^ is used to indicate power. For example  $2^3 = 8$ .

### Question 16

1 pts

Determine which pairs of statements are equivalent.

1. If Proposition 111 passes, freeways are improved.
2. If Proposition 111 is defeated, freeways are not improved.
3. If the freeways are improved, Proposition 111 passes.
4. If the freeways are not improved, Proposition 111 does not pass.

☐ 2 and 4

☐ 2 and 3

☐ 1 and 4

☐ 1 and 3

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**NOTE:** in some answers, the symbol  $^$  is used to indicate power. For example  $2^3 = 8$ .

### Question 20

1 pts

Determine whether the following argument is valid or invalid.

If 12 divides 709,438 then 3 divides 709,438.

If the sum of the digits of 709,438 is divisible by 9 then 3 divides 709,438.

The sum of the digits of 709,438 is not divisible by 9.

Therefore, 12 does not divide 709,438.

- ☒ The argument is valid.
- ☐ The argument is invalid.

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