

CS 3653 – Discrete Mathematics for Computer Science

Assignment # 2	Due – Jan 24, 2022, 11:59pm (CST)
Chapter # 1.4 - 1.6	Max. Points # 25

SN	QUESTION	Pts
1	<p>Let $N(x)$ be the statement “x has visited North Dakota,” where the domain consists of the students in your school. Express each of these quantifications in English.</p> <p>a) $\exists x N(x)$ b) $\forall x N(x)$ c) $\neg \exists x N(x)$ d) $\exists x \neg N(x)$ e) $\neg \forall x N(x)$ f) $\forall x \neg N(x)$</p>	<p>6</p> <p>X</p> <p>0.5</p>
2	<p>Let $C(x)$ be the statement “x has a cat,” let $D(x)$ be the statement “x has a dog,” and let $F(x)$ be the statement “x has a ferret.” Express each of these statements in terms of $C(x)$, $D(x)$, $F(x)$, quantifiers, and logical connectives. Let the domain consist of all students in your class.</p> <p>a) A student in your class has a cat, a dog, and a ferret. b) All students in your class have a cat, a dog, or a ferret. c) Some student in your class has a cat and a ferret, but not a dog. d) No student in your class has a cat, a dog, and a ferret. e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.</p>	<p>5</p> <p>X</p> <p>0.5</p>
3	<p>Determine the truth value of each of these statements if the domain of each variable consists of all real numbers.</p> <p>a) $\exists x (x^2 = 2)$ b) $\exists x (x^2 = -1)$ c) $\forall x (x^2 + 2 \geq 1)$ d) $\forall x (x^2 \neq x)$</p>	<p>4</p> <p>X</p> <p>0.5</p>
4	<p>Suppose that the domain of the propositional function $P(x)$ consists of $-5, -3, -1, 1, 3$, and 5. Express these statements without using quantifiers, instead using only negations, disjunctions, and conjunctions.</p> <p>a) $\exists x P(x)$ b) $\forall x P(x)$ c) $\forall x ((x \neq 1) \rightarrow P(x))$ d) $\exists x ((x \geq 0) \wedge P(x))$ e) $\exists x (\neg P(x)) \wedge \forall x ((x < 0) \rightarrow P(x))$</p>	<p>5</p> <p>X</p> <p>0.5</p>

5	<p>Suppose that the domain of $Q(x, y, z)$ consists of triples x, y, z, where $x = 0, 1$, or 2, $y = 0$ or 1, and $z = 0$ or 1. Write out these propositions using disjunctions and conjunctions.</p> <p>a) $\forall y Q(0, y, 0)$ b) $\exists x Q(x, 1, 1)$ c) $\exists z \neg Q(0, 0, z)$ d) $\exists x \neg Q(x, 0, 1)$</p>	4 X 0.5
6	<p>If the domain consists of all integers, what are the truth values of these statements?</p> <p>a) $\exists!x (x > 1)$ b) $\exists!x (x^2 = 1)$ c) $\exists!x (x + 3 = 2x)$ d) $\exists!x (x = x + 1)$</p>	4 X 0.5
7	<p>Let $C(x, y)$ mean that student x is enrolled in class y, where the domain for x consists of all students in your school and the domain for y consists of all classes being given at your school. Express each of these statements by a simple English sentence.</p> <p>a) $C(\text{Randy Goldberg}, \text{CS 252})$ b) $\exists x C(x, \text{Math 695})$ c) $\exists y C(\text{Carol Sitea}, y)$ d) $\exists x (C(x, \text{Math 222}) \wedge C(x, \text{CS 252}))$ e) $\exists x \exists y \forall z ((x \neq y) \wedge (C(x, z) \rightarrow C(y, z)))$ f) $\exists x \exists y \forall z ((x \neq y) \wedge (C(x, z) \leftrightarrow C(y, z)))$</p>	6 X 0.5
8	<p>A discrete mathematics class contains 1 mathematics major who is a freshman, 12 mathematics majors who are sophomores, 15 computer science majors who are sophomores, 2 mathematics majors who are juniors, 2 computer science majors who are juniors, and 1 computer science major who is a senior. Express each of these statements in terms of quantifiers and then determine its truth value.</p> <p>a) There is a student in the class who is a junior. b) Every student in the class is a computer science major. c) There is a student in the class who is neither a mathematics major nor a junior. d) Every student in the class is either a sophomore or a computer science major. e) There is a major such that there is a student in the class in every year of study with that major.</p>	5 X 0.5
9	<p>Rewrite each of these statements so that negations appear only within predicates</p>	5 X

[illegible]