§1.1

WrittenHW #1

TCSS 321

1. [2] Let p and q be the propositions:

   p : I will buy a ticket for the lottery.

   q : I will win the five million dollar jackpot.

   Express the following in an English sentence.

   (a) $p \to q$

   (b) $p \wedge q$

2. [3] Determine whether each of these conditional statements is true or false.

   (a) If $1 + 1 = 3$, then pegasus exists.

   (b) If $1 + 1 = 2$, then pig can fly.

   (c) If $2 + 5 = 7$, then $1 + 3 = 4$

3. [2] Write each of these statements in the form "If p, then q" in English.

   (a) It is necessary to buy the boss lunch to get promoted.

   (b) You can access the website only if you pay a subscription fee.

4. [1] State the converse, contrapositive, and inverse of each of the following statement: "If it rains tonight, then I will stay at home."

5. [2] Construct a truth table either by hand or by using Sage for the compound propositions.

   (a) $p \oplus (p \vee q)$

   (b) $(p \wedge q) \to (p \vee q)$

§1.2 # WrittenHW #1 TCSS 321

1. [3] Translate the given statement into propositional logic *making sure you define the propositions you use.*

   (a) "You can see the movie only if you are over 13 years old or you have permission of a parent."

   (b) "Access is granted whenever the user has paid the $20 fee and enters a valid password."

   (c) "If the user has not entered a valid password but has paid the $20 fee, then access is granted."

2. [3] You encounter two people, A and B on an island inhabited by only knights and knaves. The knights always tell the truth and knaves always lie. A says "The two of us are both knights" and B says "A is a knave." If possible, determine what these two people are and justify your conclusions.

3. [2] Find the output of the combinatorial circuits from §1.2 #40b.

4. [2] Construct a combinatorial circuit using inverters, OR gates, and AND gates that produces the output $(\neg p \wedge r) \vee (\neg q \wedge r)$

§1.3 # WrittenHW #1 TCSS 321

1. [3] Use DeMoran's law to find the negation of the following:

   "Chase knows Java and calculus."

2. [4] Use words or a table to show $(p \to q) \vee (p \to r)$ is logically equivalent to $p \to (q \vee r)$

3. [3] Find a compound proposition involving the propositional variables a, b, and c that is true when exactly two of a, b, and c are true and false otherwise.

WrittenHW #1

1. [1] Let $P(x)$ be the statement “The word x contains the letter a”. What are the truth values for the following?
   (a) $P(cake)$
   (b) $P(pie)$
2. [2] Translate these statements into English where $R(x)$ is “x is a rabbit” and $H(x)$ is “x hops” and the domain consists of all animals.
   (a) $\forall x(R(x) \rightarrow H(x))$
   (b) $\forall x(R(x) \wedge H(x))$
3. [2] Let $C(x)$ be the statement “x has a catfish”, let $D(x)$ be the statement “x has a dog”, and let $S(x)$ be the statement “x has a scorpion”. Express each of the statements below in terms of $C(x)$, $D(x)$, and $S(x)$, quantifiers, and local connectives. Let the domain consists of all students in your class.
   (a) All students in your class have a catfish, a dog, or a scorpion.
   (b) Some student in your class has a catfish and a scorpion, but not a dog.
4. [2] Translate the following in two ways, each into logical expressions using predicates, quantifiers, and local connectives. First let the domain consists of the students in your class and second, let it consist of all people.

   “Everyone in your class has a smart phone”
5. [3] Express each of these statements using quantifiers. Then form the negation of the statement so that no negation is to the left of a quantifier. Next, express the negation in simple Engish.
   (a) Every koala can climb.
   (b) No monkey can speak English.