Computer Science G12

Term 1, Review Test
Date: Thu. 9 November 2017

Name:

1. (30%) Answer the following questions:

   (a) Complete the table by converting the values to the different base systems.

Binary	*Hex*	*Dec*
1 1011 1110 1110 1101		
	$FEAD$	
		65537
		25/8
		71/3

   (b) Convert the numbers -37 and -256 into binary using 2-complement. Make sure your answer has a bit-length that is multiple of a byte.

   (c) Can the above fractional values be expressed exactly in those base systems? If not, find the smallest two bases where that's possible.

2. (10%) What follows are the transition rules of a Turing Machine. Write down the computations steps when this machines starts at state and input given by the first line below. Does this TM halt for this "program"?

$$
\begin{array}{lcl}
(A,1) & \longrightarrow & (1,C,\rightarrow) \\
(A,0) & \longrightarrow & (0,A,\leftarrow) \\
(C,0) & \longrightarrow & (1,A,\rightarrow) \\
(C,1) & \longrightarrow & (0,D,\leftarrow) \\
(D,1) & \longrightarrow & (0,A,\leftarrow) \\
(D,0) & \longrightarrow & (0,C,\rightarrow)
\end{array}
$$

A	$1.0\,0\,0\,1\,1\,E$

3. (20%) Answer the following questions:

   (a) From $p \to q$ and $q \to p$, conclude $\neg p \wedge \neg q \vee q \wedge p$ using a Truth Table.

   (b) Idem, but prove it algebraically.

4. (10%) Prove that the expression $(\neg((p \vee q) \wedge r))$ is a *wff* in propositional logic.

5. (30%) We defined the symbol $\vDash$ to denote *arguments* and we said that the argument $A \vDash B$ is valid **iff** $\vDash A \to B$, that is, we can rewrite the argument $A \vDash B$ as the statement "$A \to B$ is a tautology". Consider the expression $A \equiv p \to q,\ r \to s,\ p \vee r \vDash q \vee s$.

   (a) For any given expression X, if we state that $\vDash X$, what can we say about $\neg X$? How can we express this using the symbol $\vDash$?

   (b) Rewrite expression A as a tautology *argument*.

   (c) Determine wether the argument A is or not valid using truth trees.