CECS 419-519, Writing Assignment 1, Due 8:00 am, February 2nd, 2024, Dr. Ebert

Directions

Make sure name is on all pages. Order pages (front and back) so that solutions are presented in their original numerical order. **Please no staples or folding of corners (your papers won't get lost).** Show all necessary work and substantiate all claims. Avoid plagiarism.

Problems

1. Do the following.

    (a) Provide the instructions of the URM program P that computes the function $f(n) = n^2$. Use the online URM simulator to verify that your URM is correct. (10 pts)

    (b) Briefly describe the idea behind your program and the purpose of each register. (10 pts)

2. Prove that the π encoding function described in lecture is a one-to-one correspondence between $\mathcal{N} \times \mathcal{N}$ and $\mathcal{N}$. Hint: for each $z \in \mathcal{N}$, show that there is a unique pair $(x, y) \in \mathcal{N} \times \mathcal{N}$ for which $\pi(x, y) = z$. (15 pts)

3. Do the following.

    (a) Provide the Gödel number e for the program $P = J(1, 2, 7), S(2), S(2), S(2), S(3), J(1, 1, 1), T(3, 1)$. Write e as a sum of powers of two minus one. (10 pts)

    (b) Apply the decoding functions to e in order to verify that your answer to part a is correct. Show all work. (10 pts)

    (c) Describe $\phi_e(x)$, W_e, and E_e. Justify your answers. (10 pts)

4. Prove that there is a total computable function $h(n)$ for which, for all $n \geq 0$, $\phi_{h(n)}(x) = x^n$. Hint: you may assume that x^n is a computable function of two variables. (15 pts)