北海道大学
アルゴリズム研究室２０１０
ツォイクマン十益
湊真一
大久保好章

平成２２年度前期
コンピューターサイエンス演習 I

平成22年 7月 10日

提出期限：平成２２年 ７月 ２６日

演習第十二

Solve at least three of the following four problems.

1. Prove or disprove the following two assertions. In case your answer is affirmative, provide a Turing program.

(12.1) The binary addition function is Turing computable provided that the inputs are made in unary presentation.

(12.2) The exponentiation function $f(n) = 2^n$ is Turing computable provided that the inputs n are made in unary presentation. Does your anwser change if the inputs are made in binary?

2. Prove the following:

Let $n \in \mathbb{N}$*, let* $\tau \in \mathcal{T}^n$ *and let* $\psi \in \mathcal{T}^{n+2}$*. Then we have: if*

$$\begin{aligned} \phi(x_1, \ldots, x_n, 0) &= \tau(x_1, \ldots, x_n) \\ \phi(x_1, \ldots, x_n, y+1) &= \psi(x_1, \ldots, x_n, y, \phi(x_1, \ldots, x_n, y)) \ , \end{aligned}$$

then $\phi \in \mathcal{T}^{n+1}$*.*

3. Prove the following:

Let $n \in \mathbb{N}^+$*; then we have:*

if $\tau \in \mathcal{T}^{n+1}$ *and* $\psi(x_1, \ldots, x_n) = \mu y[\tau(x_1, \ldots, x_n, y) = 1]$ *then* $\psi \in \mathcal{T}^n$*.*

4. (a) *Construct a TM accepting* L_{pal2}*.*

   (b) *Construct a TM accepting* $L = \{ww \mid w \in \{0,1\}^*\}$*.*