MFCS: Problem set 2

1. Let c be any number. Show that the following problems are undecidable.

   the input or Acceptance problem: '$c \in W_x$' $\Leftrightarrow$ '$P_x(c) \downarrow$' $\Leftrightarrow$ '$c \in Dom(\phi_x)$'.

   the output or Printing problem: '$c \in E_x$' $\Leftrightarrow$ '$c \in Ran(\phi_x)$'.

2. Show that the following problems are undecidable:

   (a) '$x \in E_x$'
   (b) '$W_x = W_y$'
   (c) '$\phi_x(x) = 0$'
   (d) '$\phi_x(y) = 0$'
   (e) '$x \in E_y$'
   (f) 'ϕ_x is total and constant'
   (g) '$W_x = \phi$'
   (h) 'E_x is infinite'
   (i) '$\phi_x = g$', where g is any fixed computable function.

3. Show that there is no total computable function $f(x, y)$ with the following property: if $P_x(y)$ stops, then it does so in $f(x, y)$ or fewer steps.