# SNU 4541.664A Program Analysis: Quiz 1

10/13/2008

1. (10pts) Fill in the boxes below:

   규칙 집합 $\Phi$는 함수 $\phi$를 정의:

   $$\phi(Y) = \{x \mid \frac{X}{x} \in \Phi, \square\}$$

   $\Phi$ 규칙들이 정의하는 집합은 함수 $\phi$에 의해서 닫혀있는 집합중에서

   $$\bigcap\{X|\square\}$$

   이다. 이 집합은 $\phi$의 최소고정점(least fixed point)이다.

2. (10pts) If sets $A$ and $B$ are cpos, then why is the set $A \to B$ of the continuation functions from $A$ to $B$ with the point-wise order a cpo?

3. (25pts) Explain about the fixpoint induction proof method.

4. (25pts) Consider the following language:

   $$\begin{array}{rcl} C & \to & \texttt{skip} \\ & | & x \texttt{ := } E \\ & | & C \texttt{ ; } C \\ & | & \texttt{if } E\ C\ C \\ & | & \texttt{while } E\ C \\ E & \to & n \quad (n \in \mathbb{Z}) \\ & | & E \texttt{ + } E \\ & | & \texttt{-} E \end{array}$$

   Define its semantics using the evaluation context style.

5. (30pts) Fill in the boxes below:

We define the semantics $[\![\mathcal{C}]\!]$ of program $\mathcal{C}$ be the set of all states (memory and control state) reachable from the set $I$ of initial states.

Let $\tau_{\mathcal{C}}$ be the function that maps from a state to a state after one-step transition. The natural extension $T_{\mathcal{C}}(X)$ of $\tau_{\mathcal{C}}$ for a set $X$ of states is

$$T_{\mathcal{C}}(X) = \{s' \mid \tau_{\mathcal{C}}(s) = s', s \in X\}.$$

Then

$$[\![C]\!] = \mathit{fix} F_{\mathcal{C}}$$

where

$$F_{\mathcal{C}}(X) = \square \cup \square.$$