Name: SHIVAM VERMA (7)

Entry: 2012CS10253 Gp: 3

Indian Institute of Technology Delhi
Department of Computer Science and Engineering

CSL302

January 17, 2014

Programming Languages

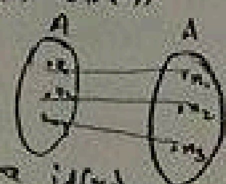
10 minutes

Quiz 1

Maximum Marks: 10

Q1. (2+4 marks) **Total functions.** A function $f : A \to B$ is called *total* if $predom(f) = dom(f)$. Show that (i) the identity maps $id_A : A \to A$ are total functions; (ii) if $f : A \to B$ and $g : B \to C$ are total functions, then so is $f;g : A \to C$, where $(f;g)(x) = g(f(x))$.

(i) $id_A : A \to A$

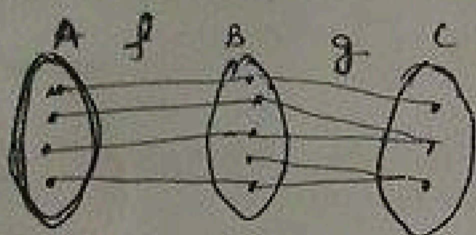


for every x_i in A, ~~there is some~~ $id(x_i) = x_i$ (only one value)
There is no diversion from one to many ∴ It is a valid f^n.

for every x_i in A, there is a corresponding $id(x_i) = x_i$ in A.
⇒ $predom(id_A) = dom(id_A)$.
∴ total f^n

✓

(ii)



$f;g : A \to C$

$f(x)$ takes x from A, for every $x_i \in A$, there is $f(x_i)$ in B (given)

also given, for every $b_i \in B$, there is $g(b_i) \in C$

✓

∴ for composition $g(f(x))$, takes ~~address~~ for $\forall a_i \in A$, there is $b_i \in B$ and for that $b_i \in B$, there is $c_i \in C$

∴ $f;g : A \to C$ is total.

Q2. (4 marks) **Recursive datatypes.** Suppose we have a simple language of expressions consisting of (i) Integers; (ii) Addition of two expressions; (iii) Multiplication of two expressions. Write a data type definition (in OCaml) to represent expressions. Please provide appropriate constructors for each case.

type exp = ... | S of exp ;; Negative Int ?

(i) let rec integ... function (if n=0) then Z , else

✗