

Sat 27 Mar 2021

**COL226: Programming Languages
Quiz 4**

45 minutes

Max marks 10

Instructions:

1. Download the paper.
2. Write your name and entry number in the designated space on top and *do not forget to sign the honour statement below.*
3. Answer the question(s) in the appropriate space provided starting from this page.
4. Scan the paper with your completed answer.
5. Upload it on Gradescope 2002-COL226 page within the given time. *Make sure the first page with your name, entry no and signature is also the first page of your uploaded file*
6. Late submissions (within 5 minutes of submission deadline) on the portal will attract a penalty of 20% of the total marks.
7. Email submissions after the closing of the portal will not be evaluated (You get a 0).
8. Uploads without the first page details (including signature) may be awarded 0 marks.

I abide by the Honour code that I have signed on my admission to IIT Delhi. I have neither given any help to anybody nor received any help from anybody or any site on the internet in solving the question(s) in this paper.

Signature:

Date:

Consider the following AST structure (similar to what was discussed in the class).

```

structure AST =
struct

  type id = string
  datatype binop = Add | Sub | Mul | Div | Eq

  datatype decl = ValDecl of id * exp

  and exp = NumExp of int
    | StringExp of string
    | VarExp of id
    | BinExp of binop * exp * exp
    | LetExp of decl * exp

  datatype value = IntVal of int
    | StringVal of string

  type environment = (id * value) list

  fun envLookup (var:id, env:environment) =
    case List.find (fn (x, _) => x = var) env of
      SOME (x, v) => v
    | NONE => raise Fail "Evaluation Error"

  fun envAdd (var:id, v:value, env: environment) =
    (var, v)::env

end

```

Complete the `evalExp` and `evalBinExp` in the structure EVALUATOR below (where it says *(* fill here *)*) that allows for the evaluation of input integer arithmetic strings.

```

structure EVALUATOR =
struct
  open AST

```

```
val brokenTypes = Fail "Error in evaluation!"

fun evalExp(e:exp, env:environment):value =
  (* fill here *)
and
  evalBinExp (e1:exp, b:binop, e2:exp, env:environment):value =
    (* fill here *)
end
```