Computer Science and Engineering
IIIT Kalyani, West Bengal

Compiler Design (CS 501): Autumn: 2019-2020
3^{rd} Year B.Tech.

Quiz - I (30^{th} August, 2019) *Time: 09:45-10:15 (Marks: 20)*

Name: **Roll No.:**

Write short and precise answer to each question.

1. `let a = 1,2,3;;` What is the type of the variable `a`?

   Ans. `int * int * int`

2. Consider OCAML definitions `let add (x,y) = x+y;;` and `let addC x y = x+y;;`. What is the difference between the types of `add` and `addC`?

   Ans. The type of `add` is `int * int -> int`. But the type of `addC` is `int -> int -> int`.

3. Consider the following definitions:
   ```
   let addC x y = x+y;;
   let addX = addC 5;;
   addX 6;;
   ```
   What is the type of `addX`? And what final value is printed? Or is it an error?

   Ans. It is not an error. Type of `addX` is `int -> int` and the value is 11.

4. We define following functions where '`^`' is string concatenation operator.

   ```
   let cat x y = x ^ " " ^ y;;
   let rec appNx n x = if n = 0 then ""
                       else cat (appNx (n-1) x) x;;
   ```

   What is the final value printed for `appNx 5 "5";;`?

   Ans. `" 5 5 5 5 5"`

5. Write a function to print a string of the form "`+ * * * * * * * * * +`" using `cat` and `appNx` of Q4, where number of '`*`'s is a parameter.

   Ans. `let psp n = cat (cat "+" (appNx n "*")) "+";;`

Name: **Roll No.:**

6. What is the final value printed?

```
let rec bitS n = match n with
        0 -> 0
      | x -> (n mod 2) + (bitS (n/2));;
bitS 127;;
```

Ans. 7

7. The Newton's method to find an approximate root of $f(x) = 0$ uses the following recurrence relation where x_0 is the *initial guess*.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}, \text{ if } f'(x_n) \neq 0.$$

Following OCAML function `crt` computes an approximate root of some $f(x)$. Find $f(x)$ and justify your answer.

```
let rec f x x1 x2 err =
    if abs_float (x1 -. x2) < err
    then x2
    else let newX2 = x1 -. ((x1 /. 3.0) -. (x /. 3.0 /. (x1 *. x1))) in
         f x x2 newX2 err;;
let crt x err = f x x (x/.2.0) err;;
```

Ans. $x^3 - n = 0$, where n is a real number.

8. What is the final output of the following OCAML code?

```
let rec what n =
    if n = 0 then 0
    else n+(what (n-1));;
let rec appL f l =
    if l=[] then []
    else [f (List.hd l)] @ (appL f (List.tl l));;
appL what [0;1;2;3;4;5];;
```

Ans.

```
- : int list = [0; 1; 3; 6; 10; 15]
```