

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
FIRST SEMESTER 2017 – 2018
PRINCIPLES OF PROGRAMMING LANGUAGES (CS F301)
COMPREHENSIVE EXAM (REGULAR)

Date: 02.12.2017

Duration: 180mins.

Weightage: 40% [80M]

Type: Closed Book

Please note: 1. All parts of the questions have to be answered consecutively.

2. Your Answers should be brief.

Q1. Features of a Programming Language

[5 M]

a) Sravan and Arvind have implemented the same concept in different ways as shown below.

	Readability	Writeability	Reliability	Justification
Arvind's code #define Red 0 #define Blue 1 #define Green 2				
Sravan's code enum colors {Red, Blue, Green};				

Fill the empty blank entries of the table with yes/no to evaluate their code in terms of Readability, Writeability and Reliability. Give one-line justification for each student in the last column about the strength / weakness of their code.

Q2. Syntax

[3+2=5 M]

a) Write a BNF grammar to implement a multiple assignment statement which accepts strings as follows:

$a=b$

$a,b=c,d$

$a,b=c,d+b$

and reject strings like

$a,b=c+d$

$a,b=c$

Use the following definitions of Non terminals <var> and <expression> given.

<var> -> a|b|c|d

<expression> -> <var> | <var> + <var>

b) Draw a parse tree for the input string $a,b=c,d+b$

Q3. Data Types

Briefly explain the relationship between "ordinal type" and "subrange type". Explain why it might be useful to have such datatypes with examples in C language.

[3 M]

Q4. Procedures

a) Write a single short program that prints the word dynamic if the language implementation uses dynamic scoping, and prints the word static if the implementation uses static scoping.

[4M]

b) What value will be printed assuming that C language uses the following parameter passing mechanisms:

(i) Pass by value, (ii) Pass by value-result, (iii) Pass by name.

[3X2=6 M]

Consider the following C program:	main(){
int i;	i=1;
int b[5];	b[1]=3;
void q (int x){	b[2]=4;
i++;	q(b[i]);
x++;	printf("%d \n", b[i]);
}	}

Q5. Heap Management and Garbage Collection

a) Automatic variables and dynamic variables are distinguished by their method of allocation. Why is it also useful to separate them into groups according to the allocated locations? (in particular, stack-dynamic vs. heap-dynamic)

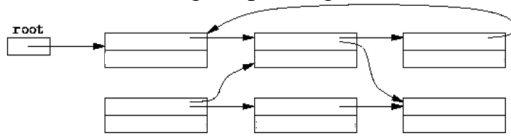
[3 M]

b) Given the following C code snippet. Assuming that C Language Run time memory model has stack, heap and static/global memory segments, show all the live variables and their pointers when the sprintf function is executing. [Note: You are expected to draw the diagram]

[4 M]

char *cat(char *x, int i) { static int r = 4; x[3] = 'h'; char *result = (char *)malloc(20); sprintf(result, "%s x %d", x, i); return result; }	int main() { char *s = "my cat"; int z = 12; cat(s, z); }
---	---

[2+2+2=6M]



- i. If Mark and Sweep is used for garbage collection show the state of the heap after Mark phase and the sweep phase.
- ii. If Cheney's Algorithm is used for garbage collection show the state of the heap after the garbage collection.
- iii. Assume that you are implementing an online banking system and a programming language X uses Mark and Sweep while Y uses Cheney's Algorithm for garbage collection. Which language you would choose to build your application if lot of heap objects are created and why?

a) Write a program in Prolog to find out the median of a list of numbers. [5 M]

b) Given the following database of Facts/Rules in Prolog. [4 M]

 $q(d). \quad q(e). \quad q(f). \quad q(g). \quad r(e).r(g).$

[3+3+8+2+5=21 M]

i. $(\lambda f. \lambda x. f (f x)) (\lambda u. z) a b$

ii. $(\lambda f. \lambda y. \lambda x. x (y f)) y x f$

Prove *or false true = true*

```
(define (square x) (* x x))
```

```
(define (squaredsum x y) (+ (square x) (square x)))
```

Evaluate the applicative and normal order of the function application (squaredsum (+1 2)(+1 3))

```
(cons (cdr '(17 18)) (car '(19 20)))
```

e) Write a scheme function named `count` which accepts an element `x` and a list `L` as parameters and returns the number of occurrences of `x` in list `L`.

a) Given the following program in C language having different type of errors. Complete the entries in **Table-1** [5 M]

```
2. int main () {
```

```
3.    int i ;
```

4. $int\ j = k + 1;$

5. $int\ a[] = \{1,2,3\}$

6. $j = a + 6$;

7. $a[4] = 7$;

```
8. printf("hello world\n) ;
```

9. }

Line No	Name of the error	Phase of the compiler in which the error is detected
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Table-1

b) Table-2 lists few concepts which exist in an imperative paradigm. Identify and write the equivalent name of the concept used in Logic and Functional paradigm. If the concept does not exist, then write as Not Available. [0.5*4=8M]

[0.5*4=8M]

statements	Imperative Paradigm	Logic Paradigm	Functional Paradigm
a=b	Assignment		
fun(a,b)	Function call		
fun(a,b)	Function call using call by value		
fun(&a,&b)	Function call using call by reference		
fun(n-1)	recursion		
int a;	Global Variable		
int a;	Local Variable		
if(a>b)	If Statement		

Table-2

******That's all folks******