

2021
B.E. (Computer Science and Engineering)
Fifth Semester
CS-504: Principles of Programming Languages

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

- I. Answer the following:-
- How many distinct parse trees can an ambiguous grammar generate for a string which is accepted by the grammar?
 - What is concurrent programming? Why concurrency is needed?
 - What is independent compilation?
 - Type conversion provides more flexibility to the user. Comment on it.
 - Why is there no assignment operation in pure functional programming? (5x2)

UNIT – I

- II. Consider following BNF grammar. The start symbol is <Pedigree>

<Pedigree> → <Name>

<Pedigree> → <Name><Parents>

<Parents> → <Person><Person>

<Person> → () | (<Pedigree>)

<Name> → <Letter> <Letter><Name>

<Letter> → A |... | Z a |... | z

For each of the following, indicate whether the string belongs to the language recognized by this grammar or not and if it does belong to the language, give a derivation:

- Charles ()
- Charles (Elizabeth)
- Charles () Philipp
- Charles () (Philipp)
- Charles (Elizabeth) (Philipp) (5x2)

P.T.O.

(2)

- III. What is Overloading? Differentiate context-independent and context-dependent overloading? Differentiate between function overloading and operator overloading? How can a method be overridable in JAVA and C++? (10)
- IV. a) Explain back tracking. What is meant by cut? What is its use?
b) Discuss various synchronization primitives in concurrent programming. (2x5)

UNIT – II

- V. a) Suppose the heap is managed with a linked list. Each node in the list is either allocated or free. The list is sorted by address. When malloc() is called, the list is searched for a free segment that is big enough (depending on the allocation algorithm), that segment is split into an allocated segment (at the beginning) and a free segment. When free() is called, the corresponding segment should merge with its neighboring segments, if they are also free. Now suppose a process has a heap of 13KB, which is initially unallocated. During its execution, the process issues the following memory allocate/deallocate calls (p1...p5 are void* pointers). In all cases, break ties by choosing the earliest segment. Also, assume all algorithms allocate memory from the beginning of the free segment they choose.
- ```
p1 = malloc(3KB)
p2 = malloc(4KB)
p3 = malloc(3KB)
free(p2)
p4 = malloc(3KB)
free(p1)
p5 = malloc(1KB).
```
- For simplicity, assume the memory begins at address 0, and ignore the memory used by the linked list itself. Show the heap allocation after the above calls, using best-fit, worst-fit and first-fit algorithms respectively. Identify the starting address of p4 and p5 for best-fit, worst-fit and first-fit.
- b) Briefly explain Reference Counting. What are its disadvantages? (6,4)
- VI. a) Explain different Polymorphic data types with the help of suitable examples.  
b) Discuss "type inference" and "type checking" in functional programming. (2x5)

(3)

- VII. a) Explain Procedural, Generic and Data abstraction in C++.
- b) Write the different classes of exceptions in Java.
- c) What features of PROLOG classify it as a logic programming language? (5,3,2)

*x-x-x*