

M.Sc. III SEMESTER EXAMINATION 2021-22

COMPUTER SCIENCE

CS - 207 : Compiler Design

Time : 4.30 hours

Max. Marks : 70

Instructions

1. The Question Paper contains 08 questions out of which you are required to answer any 04 questions. The question paper is of 70 marks with each question carrying 17.5 marks.

प्रश्नपत्र में आठ प्रश्न पूँछे गये हैं जिनमें से 4 प्रश्नों का उत्तर देना है। प्रश्नपत्र 70 अंकों का है, जिसमें प्रत्येक प्रश्न 17.5 अंक का है।

2. The total duration of the examination will be 4.30 hours (Four hours and thirty minutes), which includes the time for downloading the question paper from the Portal, writing the answers by hand and uploading the hand-written answer sheets on the portal.

परीक्षा का कुल समय 4.30 घंटे का है जिसमें प्रश्नपत्र को पोर्टल से डाउनलोड करके पुनः हस्तलिखित प्रश्नों का उत्तर पोर्टल पर अपलोड करना है।

3. For the students with benchmark disability as per Persons with Disability Act, the total duration of examination shall be 6 hours (six hours) to complete the examination process, which includes the time for downloading the question paper from the Portal, writing the answers by hand and uploading the hand-written answer sheets on the portal.

दिव्यांग छात्रों के लिये परीक्षा का समय 6 घंटे निर्धारित है जिसमें प्रश्नपत्र को पोर्टल से डाउनलोड करना एवं हस्तलिखित उत्तर को पोर्टल पर अपलोड करना है।

4. Answers should be hand-written on a plain white A4 size paper using black or blue pen. Each question can be answered in upto 350 words on 3 (Three) plain A4 size paper (only one side is to be used).

हस्तलिखित प्रश्नों का उत्तर सादे सफेद A4 साइज के पन्ने पर काले अथवा नीले कलम से लिखा होना चाहिये। प्रत्येक प्रश्न का उत्तर 350 शब्दों तक तीन सादे पृष्ठ A4 साइज में होना चाहिये। प्रश्नों के उत्तर के लिए केवल एक तरफ के पृष्ठ का ही उपयोग किया जाना चाहिए।

5. Answers to each question should start from a fresh page. All pages are required to be numbered. You should write your Course Name, Semester, Examination Roll Number, Paper Code, Paper title, Date and Time of Examination on the first sheet used for answers.

प्रत्येक प्रश्न का उत्तर नये पृष्ठ से शुरू करना है। सभी पृष्ठों को पृष्ठान्कित करना है। छात्र को प्रथम पृष्ठ पर प्रश्नपत्र का विषय, सेमेस्टर, परीक्षा अनुक्रमांक, प्रश्नपत्र कोड, प्रश्नपत्र का शीर्षक, दिनांक एवं समय लिखना है।

Questions

- 1) a) Explain the phases of compiler with a neat diagram and show the inputs and outputs of each phase in translating the following statement: 12
 $\text{amount} = \text{principle} + \text{rate} * 36.0$
- b) What advantages are there to a language-processing system in which the compiler produces assembly language rather than machine language? 5.5
- 2) a) What is an ambiguous grammar? Explain with an example. 6
- b) Write regular definitions for the languages of "all strings of lowercase letters that contain the five vowels in order". 6
- c) Describe the languages denoted by the following regular expressions: 5.5
- i) $a(a|b)^*a$
- ii) $((\epsilon|a)b^*)^*$
- iii) $(a|b)^*a(a|b)(a|b)$
- iv) $a^*ba^*ba^*ba^*$
- v) $(aa|bb)^*((ab|ba)(aa|bb)^*(ab|ba)(aa|bb)^*)^*$
- 3) a) Given the Grammar: 12
- $S \rightarrow XS | dS | \epsilon$
- $X \rightarrow Y | Zb | aY$
- $Y \rightarrow cZ$
- $Z \rightarrow \epsilon$
- i) Construct FIRST and FOLLOW sets
- ii) Construct the Predictive parsing table
- iii) Show the moves made by the predictive parser on the input "dace"
- b) Define Left recursion and Left factoring and apply the same for the Grammar: 5.5
- $E \rightarrow E * T / T$
- $T \rightarrow id + T / id$

- 4) a) Consider the following grammar, and test whether the grammar is LL(1) or not. 9
 $S \rightarrow 1AB \mid \epsilon$
 $A \rightarrow 1AC \mid 0C$
 $B \rightarrow 0S$
 $C \rightarrow 1$
- b) Consider the following context-free grammar and the string $aa + a^*$. 8.5
 $S \rightarrow SS + \mid SS * \mid a$
i) Give a leftmost derivation for the string
ii) Give a rightmost derivation for the string
iii) Give a parse tree for the string
- 5) a) The grammar $S \rightarrow aSa \mid aa$, generates all even-length strings of a's. We can devise a recursive-descent parser with backtrack for this grammar. If we choose to expand by production $S \rightarrow aa$ first, then we shall only recognize the string aa . Thus, any reasonable recursive-descent parser will try $S \rightarrow aSa$ first. 9
i) Show that this recursive-descent parser recognizes inputs aa , $aaaa$, and $aaaaaaaa$, but not $aaaaaa$.
ii) What language does this recursive-descent parser recognize?
- b) Write down steps to set precedence relationship for Operator Precedence Grammar. Design precedence table for: 8.5
 $E \rightarrow E + T \mid T$
 $T \rightarrow T * F \mid F$
 $F \rightarrow a$
- 6) a) Design grammar for the language “the set of all strings of 0s and 1s such that every 0 is immediately followed by at least one 1”. 6
b) What is L-attributed syntax directed definition? Explain with an example. 6
c) Construct the transition diagram to recognize the tokens given below. 5.5
i) Relational operation
ii) Unsigned number
- 7) a) Consider the following grammar and input string $id*id+id\$$. Construct the SLR parsing table and show whether the given input string belongs to the following grammar or not. 12
 $E' \rightarrow E$
 $E \rightarrow E + T \mid T$
 $T \rightarrow T * F \mid F$
 $F \rightarrow (E) \mid id$
- b) What is handle pruning? Explain with the help of the following grammar and input string $(a, (a, a))$. 5.5
 $S \rightarrow (L) \mid a$
 $L \rightarrow LS \mid S$
- 8) a) Explain the following code optimization techniques with examples. 9
i) Constant propagation
ii) Strength reduction
iii) Code motion
- b) What do you mean by attributed grammars? Discuss the translation scheme for converting an infix expression to its equivalent postfix form. 8.5

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