VII

Vellore Institute of Technology
CHENNAI

Reg. Number:	23BAI1038

Continuous Assessment Test (CAT) – II OCTOBER 2024

Programme	:	B Tech Computer Science and Engineering	Semester	:	FALL 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250101445 CH2024250100914 CH2024250100900
Faculty	:	Dr. S. KIRUTHIKA, Dr. NATHEZHTHA T, Dr. TAHIR MUJTABA,	Slot	:	A1+TA1
Duration	:	90 MINUTES	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		In a communication system, messages are sent using a sequence of two symbols, 'a' and 'b'. To ensure data integrity, the system requires that every message contains an equal number of 'a's and 'b's. (a) You have been tasked with designing a Context-Free Grammar (CFG) to validate these messages before they are transmitted. (5 Marks) (b) Identify a string of minimum length 6 and validate the string using LMD, RMD and parse tree. (5 Marks)	10
2.		Determine whether the following string w=aabbbbbb is in the language generated by the given grammar G using CYK algorithm $S \rightarrow AB,\ A \rightarrow BB \mid a,\ B \rightarrow AB \mid b$	10
3.		For the following regular expression $(a\|b)^*\ ((ab)^+\|(ba)^*)$ Construct a grammar G in simplified form (5 marks) Convert the grammar G into Chomsky Normal Form (CNF) G_1 (5 marks)	10
4.		a) Construct a Context Free Grammar (CFG), G for the following language $L = \{x \in \{0,1\}^* \mid$ symbol at position i is same as symbol at position i+2 and $\|x\| \geq 2\}$ (5 Marks) b) Show that $L = \{ a^p b^q \mid p > q \}$ is not regular (5 Marks)	10
5.		$L = \{(ab)^n (ba)^{n+m+k} (ab)^{m+2} (ba)^k\}$, where n, m, k>0, construct automata for	10

		the language L. NOTE: 1. ab or ba should not pass together in one single transition 2. no new variable should represent ab or ba	

**********All the best **********

VIT
Vellore Institute of Technology
CHENNAI

Reg. Number	23BAI 1202

Continuous Assessment Test (CAT) – II OCTOBER 2024

Programme	:	B. Tech Computer Science and Engineering	Semester	:	FALL 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250100534, CH2024250100912, CH2024250101447
Faculty	:	Dr. S. KIRUTHIKA, Dr. NATHEZHTHA T, Dr. ANAND M	Slot	:	A2+TA2
Duration	:	90 MINUTES	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
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Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		$L= \{(ab)^{n+m} b^n a^m \mid n,m \geq 1\}$ (a) You are tasked with creating a Context-Free Grammar (CFG) for the language L. [8 Marks] (b)validate the sample string abababbaaa using Left Most Derivation (LMD) [2 Marks]	10
2.		Consider the following context free grammar $X \rightarrow AY \mid YX \mid b$, $Y \rightarrow XY \mid YX \mid a$ For the strings bab and bbb, construct the CYK parsing table. Are these strings in L(G)?	10
3.		Imagine you are developing a syntax checker for a simplified programming language that only supports variable assignment and arithmetic operations. The language includes: • Variables (x, y, z) • Assignment (=) • Operators (+, -) The given grammar is: 1. $S \rightarrow V=E$ 2. $E \rightarrow E+E / E-E / V$	10

		3. $V \rightarrow x / y / z$ Task: a). Convert the above grammar into CNF. (5 marks) b). Validate if the statement $x = y + z - x$ can be generated using the CNF grammar by drawing a parse tree. (5 marks)	
4.		a) In a school excursion to marina beach the kids are asked to collect three colours of shells white, pale yellow and blue and collection should be arranged in the following order white followed by pale yellow and blue the count of pale-yellow shells should be greater than white shells and count of blue should be greater than pale yellow. Prove whether the above scenario is a context free language or not (5 Marks) (b) Show that $L = \{ a^n ba^m ba^{n+m} \mid n, m > 1 \}$ is not regular.(5 Marks)	10
5.		$L = \{W X^R X W^R\}$, $W \in \sum(a,b)^*$ and $X \in \sum(c,d)^*$), construct push down automata to validate the language L. NOTE: W, and X are words, W^R, X^R are reverses of the words.	10

**********All the best **********

VIT
Vellore Institute of Technology
CHENNAI

Reg. Number 23BCE1624

Continuous Assessment Test (CAT) – II OCTOBER 2024

Programme	:	BTech Computer Science and Engineering	Semester	:	FALL 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250100[illegible] CH2024250100[illegible]
Faculty	:	Dr. SATHYARAJASEKARAN K Dr. SUSEELA S	Slot	:	C1+TC1
Duration	:	90 MINUTES	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
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- Use graph sheets supplied from the exam cell as necessary
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Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		A kindergarten school conducted an event for kids, the event was to collect the balls in certain order, the colour of balls where red, blue, green and yellow. The collection of balls should be in any of the following two orders. i. First ball can be either red or blue followed by green balls in odd count and yellow balls in even count with minimal occurrences. **(or)** ii. Starting with even count of red balls followed by even count of yellow balls and last two balls can either be two blue balls or two green balls. a) Construct a regular expression for the above collection. (2 marks) b) For the regular expression identified construct a grammar G_1. (6 marks) c) Identify a sample string of minimum length 6 and validate the string using Right Most Derivation. (2 marks)	10
2.		Consider the following context-free grammar S→AB | BC, A→BA | a, B→ CC | b, C→ AB | a. Let the input string w=baaba. For the substrings {ba, aa, ab, aab, aba} construct the CYK parsing table and discuss your observation.	10
3.		For the following grammar G_2, construct an equivalent grammar G_3 in	10

		Chomsky Normal Form. S→AB | BAC | BA | D A→Aa | Bb | BC | ε B→BaB | AbB | ε C→CD | CA | CB D→a | b	
4.		a) $L_1=\{W \mid W \in \sum(a,b,c)^*$, in W the count of a is greater than the count of b and count of c is equal to count of b. Prove the language L_1 is Context Free Language or not. (5 marks) b) $L_2=\{WXW^R \mid W \in \sum(a,b)^*, X \in \sum(c,d)^*\}$ Note: W^R is reverse of the word W. Prove the language L_2 is Context Free Language or not. (5 marks)	10
5.		$L=(a^{2n}b^{n+m+2}c^{3m+1} \mid n>0, m>0)$ construct a Push Down Automata for the language L.	10

**********All the best **********

Continuous Assessment Test (CAT) – II OCTOBER 2024

Programme	:	BTech Computer Science and Engineering	Semester	:	FALL 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250100941 CH2024250102440, CH2024250100943, CH2024250100944
Faculty	:	Dr SATHYARAJASEKARAN K, Dr SHIVANI GUPTA, Dr SUSEELA S, Dr RENJITH	Slot	:	C2+TC2
Duration	:	90 MINUTES	Max. Mark		50

General Instructions:

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- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		In a kindergarten event, kids, along with their parents, were given a task to collect toffees. The collection and arrangement of toffees were based on specific roles: • **Father**: Collects two colors of toffees, namely red and green. • **Mother**: Collects yellow toffees. • **Kid**: Collects blue toffees. The toffees must be arranged in the following order: red, blue, yellow, and green.To proceed to the next level, the following conditions must be met: 1. The number of **red and green** toffees must be **equal**. 2. The number of **yellow** toffees must be **twice** the number of **blue** toffees. a) Construct a grammar G1 for the above said scenario. (8 marks) b) Identify a sample string of minimum length 5 and validate the string using parsing tree. (2 marks)	10
2.		Consider the following context free grammar S→AB | BC, A→BA | c, B→ CC | d, C→ AB | c.	10

		Check the membership of the input string w=dceed using CYK algorithm?	

3.		Imagine you are developing a text-based adventure game. The game allows the player to issue commands to control the character. These commands involve:
		• Moving in directions like north, south, east, or west.
		• Picking up objects like keys and swords.
		• Interacting with characters like speaking or attacking.
		The commands are represented in a simple way, where:
		• Movement Commands: move north, move east, etc.
		• Pickup Commands: pick key, pick sword
		• Interaction Commands: speak, attack
		The context-free grammar for these commands can be written as:
		G_2=({S,C,M,D,P,O,I}, {move, north, south, east, west, pick, key, speak, attack}, P, S}
		P
		{
		S→C | C S
		C→M | P | I
		M→move D
		D→north | south | east | west D
		P→pick O
		O→key | sword
		I→speak | attack
		}
		Convert the Given Grammar to Greibach Normal Form (GNF).
			10

4.		a) $L_1=\{a^n b^m \mid n \text{ is odd count}, m=p^2, p\geq 1\}$ Prove language L_1 is regular or not. (5 marks) b) $L_2=\{(ab)^{m+n}(ba)^{m+n} \mid n \text{ is odd, m is even}\}$ Prove language L_2 is context free language or not. (5 marks)	10
5.		$L=(p^{n+m+k} q^{k+2} r^{2m} \mid n\geq 0, m>1, k>2)$ construct a Push Down Automata for the language L.	10

**********All the best **********