Solution

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-07
QUIZ - 3(B)

Time: 25 minutes   **Marks: 30**

Name: ID: Section:

1. Give a context-free grammar that generates the language **[7+8+8=23]**
   a. $L = \{ w \in \{0, 1, 2\}^* : w = 2^i 1^j 0^k,$ where $j > 2i,\ i,j,k \geq 0\}$
   b. $L = \{ w \in \{0, 1\}^* : w$ starts with $110\}$
   c. $L = \{ w \in \{a,b\}^* : w$ is a palindrome with middle symbol "b".$\}$
2. Convert the following regular expression into context free grammar. **[7]**

$$ac^*(bc+a)(c+acb)^*$$

$$j = 2i + D$$

1. a) $2^i \underset{\underset{M}{X}}{\underbrace{1^D 1^{2i}}} \underset{N}{\underbrace{0^k}}$

$S \rightarrow MN$
$M \rightarrow 2M11 \mid X$
$X \rightarrow 1X \mid 1$
$N \rightarrow 0N \mid \epsilon$

b) $S \rightarrow 110A$
$A \rightarrow 0A \mid 1A \mid \epsilon$

c) $S \rightarrow aSa \mid bSb \mid b$

2. $S \rightarrow LMNO$
$L \rightarrow a$
$M \rightarrow cM \mid \epsilon$
$N \rightarrow bc \mid a$
$O \rightarrow PO \mid \epsilon$
$P \rightarrow c \mid acb$

Time: 25 minutes   Marks: 30

Name: ID: Section:

1. Give a context-free grammar that generates the language [7+8+8=23]
   a. $L = \{ w \in \{0, 1, 2\}^* \colon w = 2^i 1^j 0^k$, where $k > 2i$, $i,j,k \geq 0 \}$
   b. $L = \{ w \in \{0, 1\}^* \colon w$ ends with 110 $\}$
   c. $L = \{ w \in \{a,b\}^* \colon w$ is a palindrome with middle symbols "a" $\}$

2. Convert the following regular expression into context free grammar. [7]

$$ac^*(bc+a)(c+acb)^*$$

1. a)

$$2^i \overbrace{1^j 0^{D} 0^{2i}}^{x}$$

$$k = 2i + D$$

$$S \rightarrow 2SD0 \mid X$$

$$X \rightarrow MN$$
$$M \rightarrow 1M \mid \epsilon$$
$$N \rightarrow DN1D$$

b)

$$S \rightarrow A110$$
$$A \rightarrow 1A \mid 0A \mid \epsilon$$

c)

$$S \rightarrow aSa \mid bSb \mid a$$

2)

$$\underline{ac^*(bc+a)(c+acb)^*}$$

$$S \rightarrow LMNO$$

$$L \rightarrow a$$
$$M \rightarrow 1cM \mid \epsilon$$
$$N \rightarrow bc \mid a$$
$$O \rightarrow PO \mid \epsilon$$
$$P \rightarrow c \mid acb.$$

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-06
QUIZ - 3(A)

Time: 25 minutes **Marks: 30**

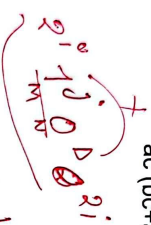Name: ID: Section:

1. Give a context-free grammar that generates the language [7+8+8=23]

   a. $L = \{w \in \{0, 1, 2\}^*: w = 2^i 10^k,\text{ where } k = 3i,\ i,j,k \geq 0\}$
   b. $L = \{w \in \{0, 1\}^*:\text{ The count of 1 in w is a multiple of three.}\}$
   c. $L = \{w \in \{a,b\}^*:\text{ The length of w is odd.}\}$

2. Convert the following regular expression into context free grammar. [7]

   $c^*a(c+acb)^* + aa$

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1. a) $2^i 1 0^j 0^i$

   $S \rightarrow 2\,S\,000 \mid X$

   $X \rightarrow 1X \mid \epsilon$

   b) $(0^*10^*10^*)^* + 0^*$

   $S \rightarrow WS \mid \epsilon \mid B$

   $W \rightarrow B1B1B1B$

   $B \rightarrow 0B \mid \epsilon$

   c) $S \rightarrow AAS \mid A$

   $A \rightarrow a \mid b$

2. $\underbrace{c^*a\,(c+acb)^*}_{X} + \underbrace{aa}_{Y}$

   $S \longrightarrow X \mid Y$

   $X \rightarrow PQR$

   $P \rightarrow cP \mid \epsilon$

   $Q \rightarrow a$

   $R \rightarrow WR \mid \epsilon$

   $W \rightarrow c \mid acb$

   $Y \longrightarrow aa$

Solution

$(0 \cup 10)^*(\epsilon \cup 0$

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BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-06
QUIZ - 3(B)

Time: 25 minutes **Marks: 30**

Name: ID: Section:

1. Give a context-free grammar that generates the language **[7+8+8=23]**
    a. L = { w ∈ {0, 1, 2}*: w = $2^i1^j0^k$, where j = 3i, i,j,k ≥0}
    b. L = { w ∈ {0, 1}*: The count of 1 in w is a multiple of four.}
    c. L = { w ∈ {a,b}*:The length of w is even.}
2. Convert the following regular expression into context free grammar. **[7]**

$$c^*a(c+acb)^* + aa$$

1. a) $2^i1^{3i}0^K$

$S \to MN$
$M \to 2M111 \mid \epsilon$
$N \to 0N \mid \epsilon$

c.) $S \to AAS \mid \epsilon$
$A \to a \mid b$

2. $S \to X \mid Y$
$X \to PQR$
$P \to cP \mid \epsilon$
$Q \to a$
$R \to WR \mid \epsilon$
$W \to c \mid acb$
$Y \to aa.$

b) $(0^*10^*10^*10^*10^*)^* / 0^*$

$S \to WS \mid \epsilon \mid B$
$W \to B1B1B1B1B$
$B \to 0B \mid \epsilon$

Solution

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-04
QUIZ - 3(B)

Time: 25 minutes   **Marks: 30**

Name: ID: Section:

1. Give a context-free grammar that generates the language **[7+8+8=23]**
    a. $L = \{ w \in \{0, 1, 2\}^*: w = 1^i0^j2^k$, where $j = i+2k$, $i,k \geq 0\}$
    b. $L = \{ w \in \{0, 1\}^*: w$ contains at most two 0's $\}$
    c. $L = \{ w \in \{a\}^*: w = a^n$, where n is a multiple of two.$\}$
2. Convert the following regular expression into context free grammar. **[7]**

$$aa + (a+bc)^*cbb(cc+b)$$

1. a) $\underbrace{1^p}_{P} \underbrace{0^i}_{} \underbrace{0^{2k}2^k}_{Q}$

$S \longrightarrow PQ$
$P \longrightarrow 1PO \mid \epsilon$
$Q \longrightarrow 00Q2 \mid \epsilon$

b) $S \longrightarrow A \mid AOA \mid AOAOA$
$A \longrightarrow 1A \mid \epsilon$

c) $S \longrightarrow aaS \mid \epsilon$

$S \longrightarrow X \mid Y$

$X \longrightarrow aa$
$Y \longrightarrow PQR$
$P \longrightarrow wP \mid \epsilon$
$w \longrightarrow a \mid bc$
$Q \longrightarrow cbb$
$R \longrightarrow cc \mid b$.

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-04
QUIZ - 3(A)

Time: 25 minutes

Name: ID: **Marks: 30**   Section:

1. Give a context-free grammar that generates the language [7+8+8=23]
   a. $L = \{ w \in \{0, 1, 2\}^*: w = 1^i 0^j 2, \text{ where } j = 2i+k, \ i,k \geq 0\}$
   b. $L = \{ w \in \{0, 1\}^*: w \text{ contains at most two 1's}\}$
   c. $L = \{ w \in \{b\}^*: w = b^n, \text{ where } n \text{ is a multiple of two.}\}$

2. Convert the following regular expression into context free grammar. [7]

$$aa + (a+bc)^* \, cbb(cc+b)$$

1.

a) $1^i \ 0^{2i} \ 0^k \ 2^k$

     $S \rightarrow PB$
     $P \rightarrow 1P00 \mid \varepsilon$
     $B \rightarrow 0B2 \mid \varepsilon$

b) $S \rightarrow A \mid A1A \mid A1A1A$
     $A \rightarrow 0A \mid \varepsilon$

c) $S \rightarrow bbS \mid \varepsilon$

2.

$$\boxed{aa + (a+bc)^* \ cbb \ (cc+b)}$$

     $S \rightarrow X \mid Y$
     $X \rightarrow aa$
     $Y \rightarrow PQR$

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-05
QUIZ - 3(B)

Time: 25 minutes **Marks: 30**

Name: ID: Section:

1. Give a context-free grammar that generates the language [7+8+8=23]
   a. $L = \{w \in \{0, 1, 2\}^*: w = 2^i 0^j 1^k,$ where $k = i+3j,\ i,j \geq 0\}$
   b. $L = \{w \in \{0, 1\}^*:$ The length of w is two more than multiple of three.$\}$
   c. $L = \{w \in \{a\}^*: w = a^n,$ where n is odd.$\}$

2. Convert the following regular expression into context free grammar. [7]

   $(a+bc)^*bcc^*(cc+ab)$

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1. **a)** $2^i 0^j 1^j 1^i$

   $S \rightarrow 2\,S\,1 \mid A$

   $A \rightarrow 0\,A\,111 \mid \varepsilon$

   b) $B \rightarrow AAAS \mid AA$

   $A \rightarrow 0 \mid 1$

   c) $S \rightarrow aaS \mid a$

2. $S \rightarrow PMNR$

   $P \rightarrow WP \mid \varepsilon$

   $W \rightarrow a \mid bc$

   $M \rightarrow bc$

   $N \rightarrow cN \mid \varepsilon$

   $R \rightarrow cc \mid ab$

BRAC University
Dept. of Computer Science and Engineering
Summer 2024
CSE331-05
QUIZ - 3(A)

Time: 25 minutes **Marks: 30**
Name: ID: Section:

1. Give a context-free grammar that generates the language [7+8+8=23]
   a. $L = \{w \in \{0, 1, 2\}^*: w = 2\lfloor 0 \rfloor 1^k$, where $k = 3i+j$, $i,j \geq 0\}$
   b. $L = \{w \in \{0, 1\}^*:$ The length of w is one less than the multiple of three.$\}$
   c. $L = \{w \in \{b\}^*: w = b^n$,where n is odd.$\}$
2. Convert the following regular expression into context free grammar. [7]

$$(a+bc)^* bcc^* (cc+ab)$$

---

1. a) $2^i 0^j 1^k 1^{3i}$

$S \rightarrow 2S111 \mid A$
$A \rightarrow 0A1 \mid \varepsilon$

b) $S \rightarrow AAAS \mid AA$
$A \rightarrow 0 \mid 1.$

c. $S \rightarrow bbS \mid b.$

2. $(a+bc)^* bcc^* (cc+ab)$

$S \rightarrow PQR$
$P \rightarrow WP \mid \varepsilon$
$W \rightarrow a \mid bc$
$Q \rightarrow bcMN$
$M \rightarrow bc$
$N \rightarrow \varepsilon N \mid \varepsilon$
$R \rightarrow cc \mid ab.$

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