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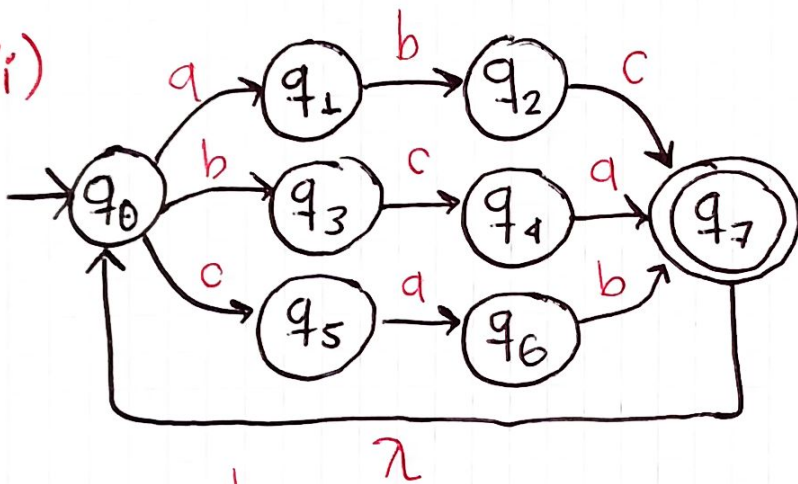Student code: 20211020013

1.

i)
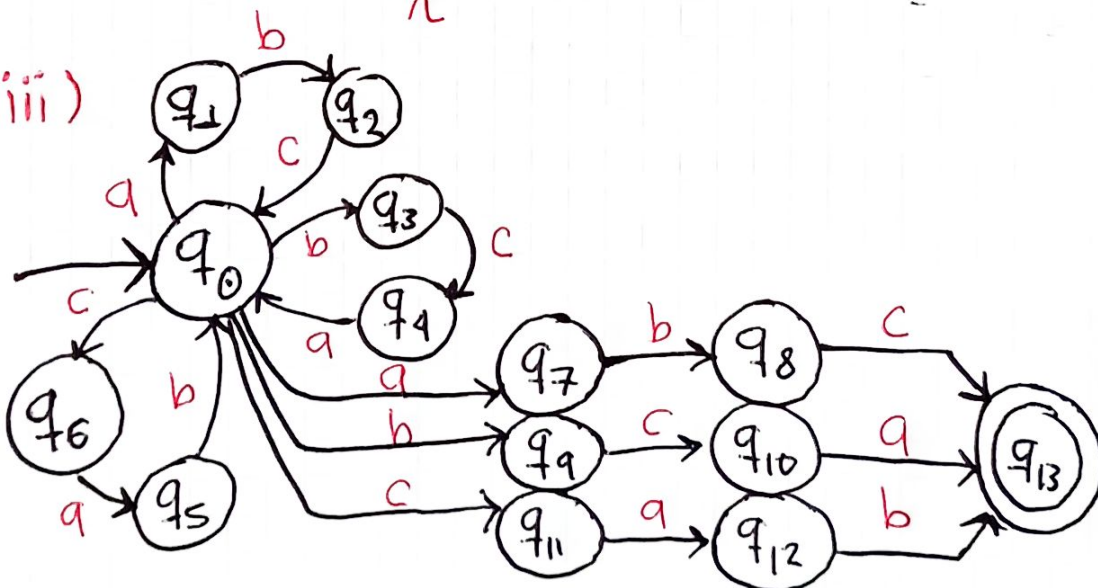

ii)

iii)

iv)

The states: q_1 with self-loop 1, q_0, q_2, q_3, q_5, q_4, q_6, q_7, q_8, q_9, q_{10}

Transitions labels: 0, 2 between q_0 and q_1; λ from q_0 to q_4; 1 from q_4 to q_8; 0 from q_8 to q_9; 1 from q_9 to q_{10}; 1, 2, 0, 2, 2, 0, 1 etc.
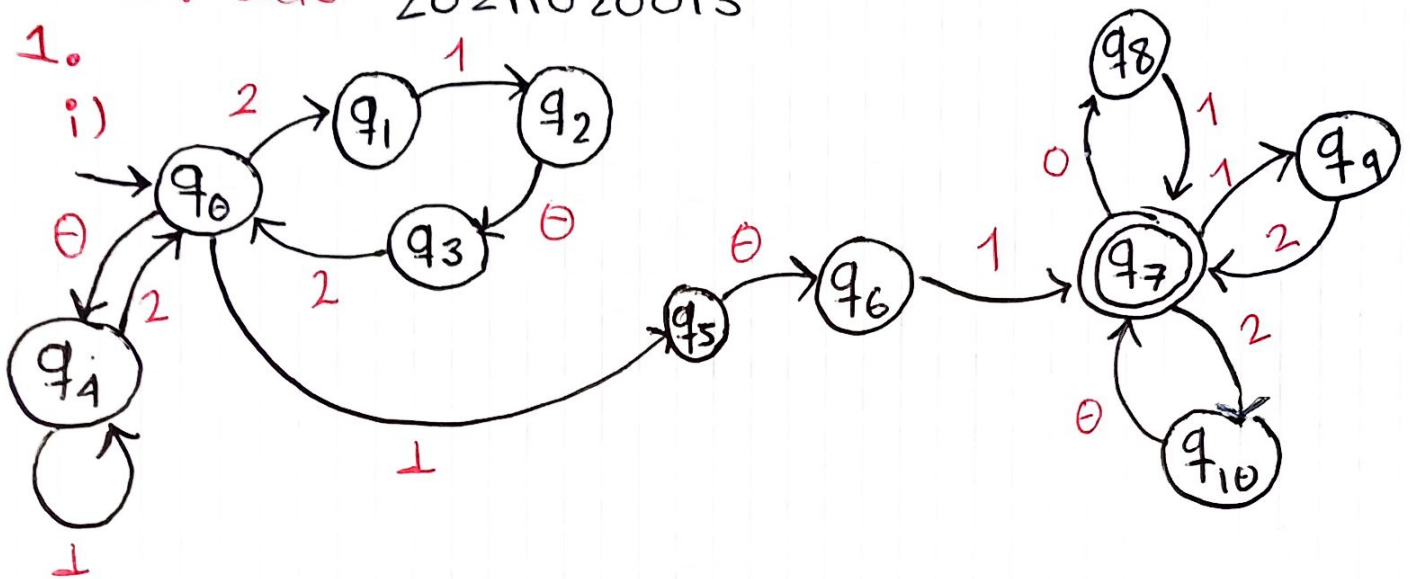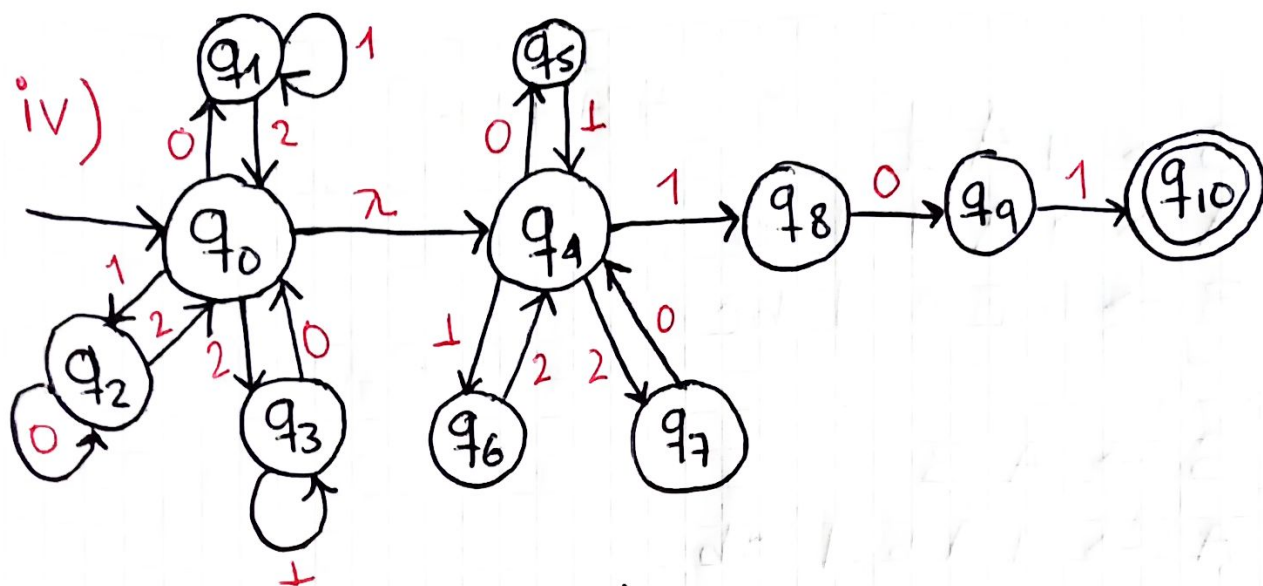
2.

i) $(00^*10^*0)1^* \cup \left((00^*10^*0)1^*1\right)^*$

$$S \to X$$
$$X \to \lambda \mid 0A$$
$$A \to 0A \mid 1B$$
$$B \to 0B \mid 0C$$
$$C \to \lambda \mid 1C \mid 1X$$

ii) $\left((a \cup b)(ca)^*(c \cup ca) \cup (b \cup c)(ac)^*(a \cup ac)\right)(\lambda \cup a(b \cup c)^*)$

$$S \to A \mid E$$
$$A \to aB \mid bB$$
$$B \to caB \mid cC \mid caC$$
$$C \to \lambda \mid aD$$
$$D \to \lambda \mid bD \mid cD$$
$$E \to bF \mid cF$$
$$F \to acF \mid aC \mid acC$$

3.

i) $S \rightarrow aAd$
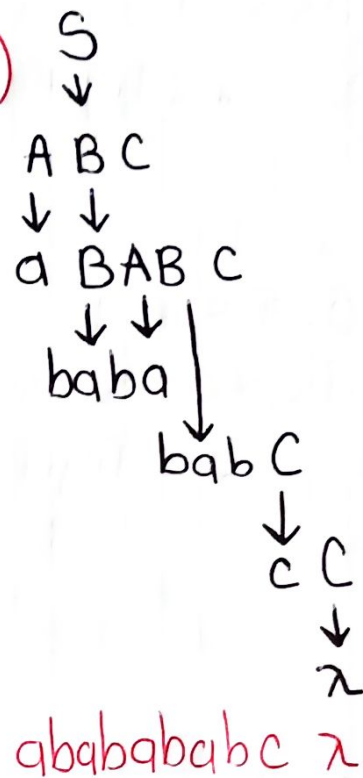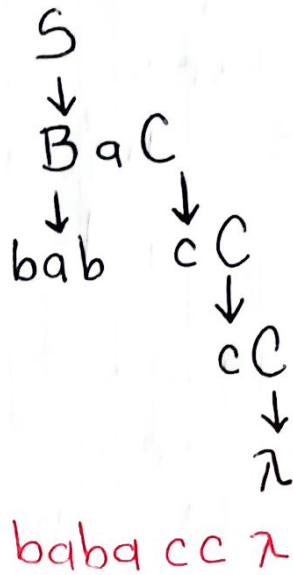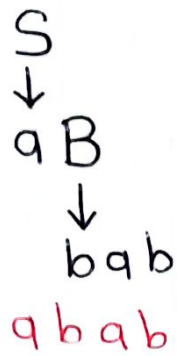$A \rightarrow aAd \mid B$
$B \rightarrow bBc \mid bc$

ii) $S \rightarrow AB$
$A \rightarrow aAb \mid ab$
$B \rightarrow cBd \mid cd$

iii) $S \rightarrow A \mid C$
$A \rightarrow aAd \mid aBd$
$B \rightarrow cBd \mid cd$
$C \rightarrow DE$
$D \rightarrow aDb \mid ab$
$E \rightarrow cEd \mid cd$

iv) $S \rightarrow A$
$A \rightarrow aAc \mid B$
$B \rightarrow bBc \mid bc$

4.

i)
```
    S
    ↓
   a B
     ↓
    bab
```
abab

ii)
```
      S
      ↓
    B a C
    ↓    ↓
   bab   c C
            ↓
           c C
             ↓
             λ
```
baba cc λ

iii)
```
       S
       ↓
     A B C
     ↓ ↓
     a BAB C
       ↓  ↓
      baba |
            ↓
          bab C
             ↓
            c C
              ↓
              λ
```
ababababc λ

5.

i) 47.236

```
<digits ><decimal ><exp>
<digits ><digits>           λ
   4       7
              . <digits >
                <digits ><digits >
                   2      <digits ><digits >
                            3        6
```

ii) 321.25 E+ 35

```
<digits ><decimal ><exp>
<digits><digits >
   3    <digits ><digits > <decimal > <exp>
           2       1      . <digits >
                            <digits ><digits >  <exp>
                               2        5
```

```
321.25  <exp>
        E+  <digits >
            <digits ><digits>
                3       5
```

iii) 0.8 E 9

```
<digits><decimal><exp>
   0        .<digits><exp>
               8      E <digits>
                           9
```

iv) 0.8 E + 9

```
<digits><decimal><exp>
   0        .<digits><exp>
               8        E+ <digits>
                             9
```

6.

i) My Variable

```
<identifier>
<letter><lsds>
   M       <letter><lsds>
              Y       <letter><lsds>
                         V      <letter><lsds>
                                   q     <letter><lsds>
                                            r     <letter><lsds>
                                                     i      <letter><lsds>
                                                              a     <letter><lsds>
                                                                      b     <letter><lsds>
                                                                              l     <letter><lsds>
                                                                                      e        λ
```

ii) temp 2

```
<identifier>
<letter><lsds>
   t    <letter><lsds>
           e     <letter><lsds>
                    m      <letter><lsds>
                             p      <letter><lsds>
                                      <digit><lsds>
                                         2        λ
```

iii) string 2 int

```
<Identifier>
<letter><lsds>
s   <letter><lsds>
    t    <letter><lsds>
         r    <letter><lsds>
              i    <letter><lsds>
                   n    <digit><lsds>
                        g    2    <letter><lsds>
                                  i    <letter><lsds>
                                       n    <letter><lsds>
                                            t    λ
```

iv) 2 Not A Variable

```
<identifier>
<digit><lsds>
2    <letter><lsds>
     N    <letter><lsds>
          o    <letter><lsds>
               t    <letter><lsds>
                    A    <letter><lsds>
                         V    <letter><lsds>
                              a    <letter><lsds>
                                   r    <letter><lsds>
                                        i    <letter><lsds>
                                             a    <letter><lsds>
                                                  b    <letter><lsds>
                                                       l    <letter><lsds>
                                                            e    λ
```