Syntax and Semantics Exam

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Computer Science, 4th semester

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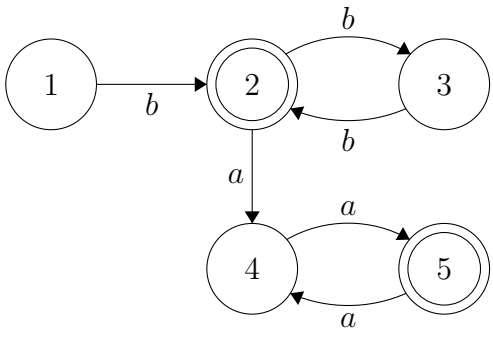
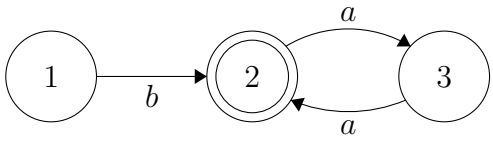
1 Exercise

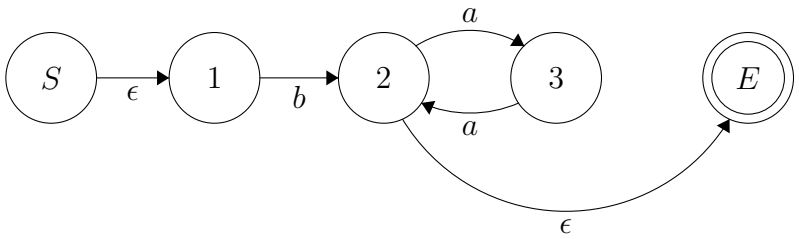
1.1

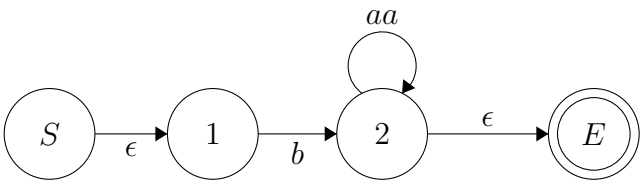


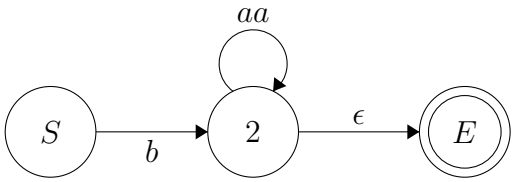
1.2

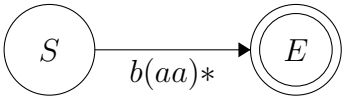


1.3



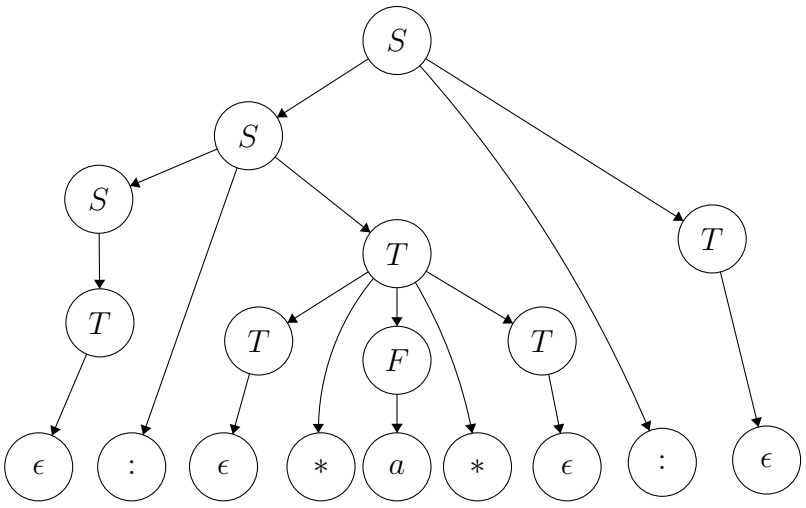






2 Exercise

2.1



2.2

```
S –> T
    | S : T
T –> T * F * T
    | <empty>
F –> a
    | [ S ]
```

Add new start rule S0, which will be the new start variable.

```
S0 –> S
S –> T
    | S : T
T –> T * F * T
    | <empty>
F –> a
    | [ S ]
```

Remove empty productions.

```
S0 –> S
```

```
     | <empty>
S -> T
     | S : T
     | S :
     |   :
     |   : T
T -> T * F * T
     |   * F * T
     | T * F *
     |   * F *
F -> a
     | [ S ]
     | [   ]
```

Remove unit rules.

```
S0 -> T * F * T
      |   * F * T
      | T * F *
      |   * F *
      | S : T
      | S :
      |   :
      |   : T
      | <empty>
S -> T * F * T
     |   * F * T
     | T * F *
     |   * F *
     | S : T
     | S :
     |   :
     |   : T
T -> T * F * T
     |   * F * T
     | T * F *
     |   * F *
F -> a
     | [ S ]
```

```
    |  [     ]
```

Fix length of rules

```
S0 –> T  A1
    |  *  A2
    |  T  B1
    |  *  B2
    |  S  C1
    |  S  :
    |     :
    |     :  T
    |  <empty>
S –> T  A1
    |  *  A2
    |  T  B1
    |  *  B1
    |  S  C1
    |  S  :
    |     :
    |     :  T
T –> T  A1
    |  *  A2
    |  T  B1
    |  *  B2
F –> a
    |  [  D1
    |  [     ]
A1 –> *  A2
A2 –> F  A3
A3 –> *  T
B1 –> *  B2
B2 –> F  *
C1 –> :  T
D1 –> S  ]
```

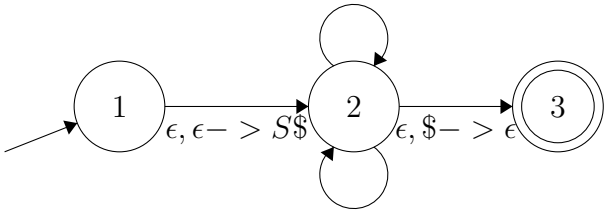
Add rules for singular terminals.

```
S0 –> T  A1
    |  AST  A2
```

```
      | T B1
      | AST B2
      | S C1
      | S SEMI
      |   SEMI
      |   SEMI T
      | <empty>
S -> T A1
   | AST A2
   | T B1
   | AST B1
   | S C1
   | S SEMI
   |   SEMI
   |   SEMI T
T -> T A1
   | AST A2
   | T B1
   | AST B2
F -> a
   | LBRACK D1
   | LBRACK   RBRACK
A1 -> * A2
A2 -> F A3
A3 -> * T
B1 -> * B2
B2 -> F *
C1 -> : T
D1 -> S ]
AST -> *
SEMI -> :
LBRACK -> [
RBRACK -> ]
```

2.3

$$(*, *- > \epsilon), (:, : - > \epsilon), (a, a- > \epsilon), ([, [- > \epsilon)(],]- > \epsilon)$$



$$(\epsilon, S- > T), (\epsilon, S- > S : T), (\epsilon, T- > T * F * T), (\epsilon, T- > \epsilon), (\epsilon, F- > a), (\epsilon, F- > [S])$$

3

4

4.1

$$[neq - tt] \quad \frac{a_1 \to v_1 \quad a_2 \to v_2}{a_1 \neq a_2 \to tt} \quad v_1 \neq v_2 \tag{1}$$

$$[neq - ff] \quad \frac{a_1 \to v_1 \quad a_2 \to v_2}{a_1 \neq a_2 \to ff} \quad v_1 = v_2 \tag{2}$$