Bit 13: CFG Exercises

Will Schell

This homework is the bases of how a context-free grammar works. In the exercises, we are given there is a task that needs to be completed. We must come up with the rules for the grammar that is needed and solve problems with our grammar rules.

1) Define the CFG for the set of all nonnegative integers with leading zeros
- Start symbol: strike
- Terminals: { 0 1 2 3 4 5 6 7 8 9 }
- Non-terminals:{ strike hit }
- Productions:
    1. strike → hit
    2. strike → hit strike
    3. hit → 1
    4. hit → 2
    5. hit → 3
    6. hit → 4
    7. hit → 5
    8. hit → 6
    9. hit → 7
    10. hit → 8
    11. hit → 9
    12. hit → 0

2) Derive 007 from the start symbol
    1. strike   (axiom)
    2. hit strike   (2)
    3. 0 strike   (12)
    4. 0 hit strike   (2)
    5. 0 0 strike   (12)
    6. 0 0 hit   (1)
    7. 0 0 7   (9)

3) Derive 2016 from the start symbol
    1. strike
    2. hit strike (2)
    3. 2 strike (4)
    4. 2 hit strike (2)
    5. 2 0 strike (12)
    6. 2 0 hit strike (2)
    7. 2 0 1 strike (3)
    8. 2 0 1 hit (1)
    9. 2 0 1 7 (3)

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1) Define the CFG for the set of all nonnegative integers with no leading zeros
- Start symbol: strike
- Terminals: { 0 1 2 3 4 5 6 7 8 9 }
- Non-terminals: { strike hit }
- Productions:
     1. strike → hit
     2. strike → hit strike
     3. hit → 0
     4. hit → 1
     5. hit → 2
     6. hit → 3
     7. hit → 4
     8. hit → 5
     9. hit → 6
     10. hit → 7
     11. hit → 8
     12. hit → 9

2) Derive 2016 from the start symbol
     1. strike   (axiom)
     2. hit strike   (2)
     3. 2 strike   (5)
     4. 2 hit strike   (2)
     5. 2 0 strike   (3)
     6. 2 0 hit strike (2)
     7. 2 0 1 strike   (4)
     8. 2 0 1 hit   (1)
     9. 2 0 1 7   (10)

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1) Define the CFG for the set of all MIDI numbers (0...127)
- Start symbol: strike
- Terminals: { 0 1 2 3 4 5 6 7 8 9 }
- Non-terminals:{ strike hit }
- Productions:
    1. strike → hit
    2. strike → hit hit
    3. strike → hit hit hit
    4. hit → 0
    5. hit → 1
    6. hit → 2
    7. hit → 3
    8. hit → 4
    9. hit → 5
    10. hit → 6
    11. hit → 7
    12. hit → 8
    13. hit → 9

2) Derive 91 from the start symbol
    1. strike
    2. hit hit (2)
    3. 9 hit   (13)
    4. 9 1   (5)