

## Syntax Charts & BNF

### Chart A's BNF

$N = \{<\text{on}>, <\text{off}>\}$

$T = \{0, 1\}$

$P = \{<\text{off}> ::= 0<\text{off}> \mid 0<\text{on}>$

$\quad <\text{on}> ::= 1<\text{off}> \mid 1$

$S = <\text{off}>$

### Chart B's BNF

$N = \{<\text{on}>, <\text{off}>, <A>\}$

$T = \{0, 1\}$

$P = \{<\text{off}> ::= 0<\text{off}> \mid 0<A>$

$\quad <A> ::= 0<A> \mid 0<\text{on}>$

$\quad <\text{on}> ::= 1<A> \mid 1<\text{off}> \mid 1$

$S = <\text{off}>$

### Justifications

#### A's justification

- 1) The chart starts with a 0, <off> is the only element that has 0, and is the starting terminal, thus <off> satisfies this case.
- 2) The chart ends with a 1, <on> is the only element that has 1 and terminate, thus <on> satisfies this case.
- 3) The chart allows repeatable 0's: (ex: 00..), <off> uses 0 and recursives back to <off> then repeatable 0's is covered.
- 4) The chart also allows repeated patterns after 1 as long as it's not last 1 in the string such as: 01, 001, 000001, 0101. Never the pattern 11. Since <off><on> can create 01 pattern and <off> is recursive to repeatable 0's, and <on> is recursive to repeated <01>'s then the patterns can all be covered.
- 5) 01 must be the end pattern since the shortest and only string combination is 01 and 01 is repeatable in the aforementioned rules.
- 6) Since all possible paths have been exhausted, therefore A's BNF has equivalent grammar to the syntax chart A.

#### B's justification

- 1) I will use all of A chart's justification is substitution with the only modification of changing all <off> elements to <A> notation and allowing <on> to have another production rule:  $1<\text{off}>$ . A's justification will serve as <A> element's justifications.

- 2) Once again, the chart starts with a 0 which  $\langle \text{off} \rangle$  is the starting nonterminal which also uses 0 in all its production rules.
- 3) The chart also supports repeatable 0's which  $\langle \text{off} \rangle$  is recursive and uses 0 so it's covered.
- 4) The chart also supports 0A which is the same as saying  $0\langle A \rangle$ .  $\langle A \rangle$  follows the rules mentioned in rule 1. Since  $\langle A \rangle$  is the same as chart A's justification. All production possible strings created in chart A are possible in chart B.
- 5) Since, the shortest string in chart B is 0A, and  $A = \langle A \rangle$ , A then produces the shortest string in  $\langle A \rangle$  which is 01. Thus, 001 is the shortest string possible for chart B. Since  $\langle \text{off} \rangle \langle A \rangle$  is covered as a production rule of starting terminal  $\langle \text{off} \rangle$  then it's covered.
- 6) Since A is the last element, that means chart B's terminating string must at least hold a value of 01. This is also covered from the aforementioned rules.
- 7) A in chart B also allows a reset back to the beginning of the chart which is covered since  $\langle A \rangle$  will eventually end up at an  $\langle \text{on} \rangle$  production rule where  $\langle \text{on} \rangle$  provides an exit that leads to the start of chart B ( $N ::= 1\langle \text{off} \rangle$ , production rule ).
- 8) Since all possible paths have been exhausted, therefore A's BNF has equivalent grammar to the syntax chart A.