CSc 600 Homework 1 - Syntax

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1. Using BNF write the syntax definitions of the following objects:

a) Natural number (1, 2, 3, ...). The answer:

⟨*natural number*⟩ ::= ⟨*non-zero digit*⟩ | ⟨*natural number*⟩ ⟨*digit*⟩

⟨*digit*⟩ ::= 0 | ⟨*non-zero digit*⟩

⟨*non-zero digit*⟩ ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

b) Unsigned integer (0, 1, 2, 3, ...). The answer:

⟨*unsigned integer*⟩ ::= 0 | ⟨*natural number*⟩

⟨*natural number*⟩ ::= ⟨*non-zero digit*⟩ | ⟨*natural number*⟩ ⟨*digit*⟩

⟨*digit*⟩ ::= 0 | ⟨*non-zero digit*⟩

⟨*non-zero digit*⟩ ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

c) Integer (..., -2, -1, 0, 1, 2, ...). The answer:

⟨*integer*⟩ ::= ⟨*sign*⟩ ⟨*unsigned integer*⟩

⟨*sign*⟩ ::= + | - | ⟨*empty*⟩

⟨*empty*⟩ ::=

⟨*unsigned integer*⟩ ::= 0 | ⟨*natural number*⟩

⟨*natural number*⟩ ::= ⟨*non-zero digit*⟩ | ⟨*natural number*⟩ ⟨*digit*⟩

⟨*digit*⟩ ::= 0 | ⟨*non-zero digit*⟩

⟨*non-zero digit*⟩ ::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

d) Odd number (..., -3, -1, 1, 3, ..., 101, ..., 2047, ...). The answer:

⟨odd number⟩	::= ⟨sign⟩ ⟨unsigned odd number⟩
⟨sign⟩	::= + | − | ⟨empty⟩
⟨empty⟩	::=
⟨unsigned odd number⟩	::= ⟨odd digit⟩ | ⟨natural number⟩ ⟨unsigned odd number⟩
⟨natural number⟩	::= ⟨non-zero digit⟩ | ⟨natural number⟩ ⟨digit⟩
⟨digit⟩	::= 0 | ⟨non-zero digit⟩
⟨non-zero digit⟩	::= 2 | 4 | 6 | 8 | ⟨odd digit⟩
⟨odd digit⟩	::= 1 | 3 | 5 | 7 | 9

e) Even number (..., -4, -2, 0, 2, 4, ..., 332, ..., 1022, ...). The answer:

⟨even number⟩	::= ⟨sign⟩ ⟨unsigned even number⟩
⟨sign⟩	::= + | − | ⟨empty⟩
⟨empty⟩	::=
⟨unsigned even number⟩	::= ⟨even digit⟩ | ⟨natural number⟩ ⟨unsigned even number⟩
⟨natural number⟩	::= ⟨non-zero digit⟩ | ⟨natural number⟩ ⟨digit⟩
⟨digit⟩	::= 0 | ⟨non-zero digit⟩
⟨non-zero digit⟩	::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
⟨even digit⟩	::= 0 | 2 | 4 | 6 | 8

f) Integer divisible by five (..., -10, 5, 0, 5, 10, ...). The answer:

⟨integer div-by-5⟩	::= ⟨sign⟩ ⟨unsigned int div-by-5⟩
⟨sign⟩	::= + | − | ⟨empty⟩
⟨empty⟩	::=
⟨unsigned int div-by-5⟩	::= 0 | 5 | ⟨natural number⟩ ⟨unsigned int div-by-5⟩
⟨natural number⟩	::= ⟨non-zero digit⟩ | ⟨natural number⟩ ⟨digit⟩
⟨digit⟩	::= 0 | ⟨non-zero digit⟩
⟨non-zero digit⟩	::= 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9