# Worksheet 5 Backus-Naur Answers

# Task 1

1. A database table holds records related to snack items.

|  |  |  |  |
| --- | --- | --- | --- |
| **UniqueID** | **StockID** | **SupplierID** | **Description** |
| 4521 | Cc8 | Cc4521 | Custard Creams |
| 7549 | GN38 | GN7549 | Ginger Nuts |
| 1872 | Lc2 | Lc1872 | Lemon Crispies |
| 6967 | RT73 | RT6967 | Rich Tea |
| 8343 | Mp9 | Mp8343 | Maple Pecan |
| 9670 | CR12 | CR9670 | Chocolate Raspberry |
| 3001 | Or5 | Or3001 | Oat Raisin |
| 4807 | MM33 | MM4807 | Malted Milk |

Generate production rules for each of the ID fields, assuming the examples given are all valid fields representing all possible formats. Two production rules are given for you. Pay careful attention to producing shorter rules and to reusing non-terminal symbols, where possible.

<digit> ::= 0|1|2|3|4|5|6|7|8|9

<upper> ::= A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z

<lower> ::= a|b|c|d|e|f|g|h|i|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z

<letter> ::= <upper> | <lower>

<uniqueid> ::= <digit><digit><digit><digit>

<stockid> ::= <upper><upper><digit><digit>|<upper><lower><digit>

<supplierid> ::= <upper><lower><uniqueid>|<upper><upper><uniqueid>

# Task 2

2. User names for logging onto a computer system are constructed to meet the following requirements:

* 1. The user’s initials. There must be one or more initials, all in lowercase.
	2. A number equal to 1 + the number of times that set of initials already appears in the user names file. The first occurrence of a set of initials is assigned the number 1.
	3. A single letter code indicating privilege level, from the set {g, p, v, s}.
	4. The last two digits of the year in which the user name was generated.

 Valid user names:

 avs4g15, bb12s99, b1v06, sret356p00

 Generate production rules for the user names.

<digit> ::= 0|1|2|3|4|5|6|7|8|9

<lower> ::= a|b|c|d|e|f|g|h|i|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z

<initials> ::= <lower> | <lower><initials>

<privilege> ::= g | p | v | s

<digits> ::= <digit> | <digit><digits>

<year> ::= <digit><digit>

<user> ::= <initials><digits><privilege><year>

# Task 3

3. (a) In a certain country, postcodes are all in the format of the following examples:

 J74E 1DE

 S43T 6BF

 Write BNF production rule(s) for these postcodes.

 <letter> ::= A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z

 <digit> ::= 0|1|2|3|4|5|6|7|8|9

 <number> ::= <digit><digit>

 <space> ::= “ ”

 <part1> ::= <letter><number><letter>

 <part2> ::= <digit><letter><letter>

 <postcode> ::= <part1><space><part2>

 (b) Write production rules for the set of positive integers.

 <zero> ::= 0

 <non\_zero\_digit> ::= 1|2|3|4|5|6|7|8|9

 <digit> ::= <non\_zero\_digit>|<zero>

 <integer> ::= <non\_zero\_digit>|<non\_zero\_digit><digit\_sequence>

 <digit\_sequence> ::= <digit> | <digit> <digit\_sequence>

 (c) The following BNF definition describes an ID number.

 <ID> ::= <code><number>

 <number> ::= <pos\_digit><digit><digit>|<pos\_digit><digit><digit><digit>

 <pos\_digit> ::= 1|2|3|4|5|6|7|8|9

 <digit> ::= 0|<pos digit>

 <code> ::= SAL|MAN|PRD|PER|ADM

 State with reasons, whethereach of the following is a valid or invalid ID number.

 MAN100 PER15 AMD456 SAL015 PRD6000

 PER15 not valid – only 2 digits AMD456 not valid – invalid code

 SAL015 not valid – must start with <pos digit>

4. An identifier in Pascal consists of a letter followed by zero or more letters and/or digits.

 Draw a syntax diagram to represent this rule. You may assume that letter and digit are already defined.

Letter

Letter

Digit

5. In a certain programming language, a real number is defined as one which has at least one digit before and after the decimal point.

 Draw a syntax diagram to represent a real number.

Digit

.

Digit

6. Explain why Backus-Naur form and syntax diagrams are used to describe the syntax of a programming language rather than using regular expressions.

 It is not always possible to represent programming constructs using a regular expression.