

## 1

**1.1**  $f(x) = x + 1, x > 0$

### Rules

1.  $\$ \rightarrow |$
2.  $|\# \rightarrow |$

### Sequence

1.  $\$||\# \rightarrow |||\#$  (Rule 1)
2.  $|||\# \rightarrow |||$  (Rule 2)

**1.2**  $f(x) = 2x, x > 0$

### Rules

1.  $| \rightarrow ||$
2.  $\$| \rightarrow |$
3.  $|\# \rightarrow |$

### Sequence

1.  $\$||\# \rightarrow \$||||\#$  (Rule 1)
2.  $\$||||\# \rightarrow ||||\#$  (Rule 2)
3.  $||||\# \rightarrow ||||$  (Rule 3)

**1.3**  $f(x, y) = x + y, x, y > 0$

### Rules

1.  $\& \rightarrow NULL$
2.  $\$| \rightarrow |$
3.  $|\# \rightarrow |$

### Sequence

1.  $\$||\&||\# \rightarrow \$||||$  (Rule 1)
2.  $\$||||\# \rightarrow ||||\#$  (Rule 2)
3.  $||||\# \rightarrow ||||$  (Rule 3)

## 2

### 2.1 Rules

1.  $(0 + 0) \rightarrow 0$
2.  $(0 + 1) \rightarrow 1$
3.  $(1 + 0) \rightarrow 1$
4.  $(0 + 2) \rightarrow 2$
5.  $(2 + 0) \rightarrow 2$
6.  $(1 + 1) \rightarrow 2$
7.  $(1 + 2) \rightarrow 0$
8.  $(2 + 1) \rightarrow 0$
9.  $(2 + 2) \rightarrow 1$

### 2.2 Sequence Example

**Sequence 1:**  $(0 + (1 + 2))$

1.  $((1 + 2) + 0) \rightarrow (0 + 0)$  (Rule 7)
2.  $(0 + 0) \rightarrow 0$  (Rule 1)

**Sequence 2:**  $(1 + (2 + 2))$

1.  $(1 + (2 + 2)) \rightarrow (1 + 1)$  (Rule 9)
2.  $(1 + 1) \rightarrow 2$  (Rule 6)

### 2.3

No, in  $((1 + 1) + (2 + 2))$  2 rules can be applied

## 3

### 3.1

Yes:  $r^+ = r\&r^*$

### 3.2

No: At least one of those operators is necessary to express an infinite quantity

## 4

$$R = (-|\epsilon)(digit)^+.(digit)^+(E(-|\epsilon)(digit)^+|\epsilon)$$

## 5

### 5.1

All strings/combinations over the alphabet  $a, b$  including the empty string

## 5.2

All strings over the alphabet  $0, 1$  which begin with 1 and end in 001 or 011

## 6

### 6.1

$$R = (b^*c|a|c|d)^*b^*$$

### 6.2

$$\begin{aligned} R = & a^*(b|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^* \\ & |a^*(c|\epsilon)a^*(b|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^* \\ & |a^*(c|\epsilon)a^*(c|\epsilon)a^*(b|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^* \\ & |a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(b|\epsilon)a^*(c|\epsilon)a^* \\ & |a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(c|\epsilon)a^*(b|\epsilon)a^* \end{aligned}$$