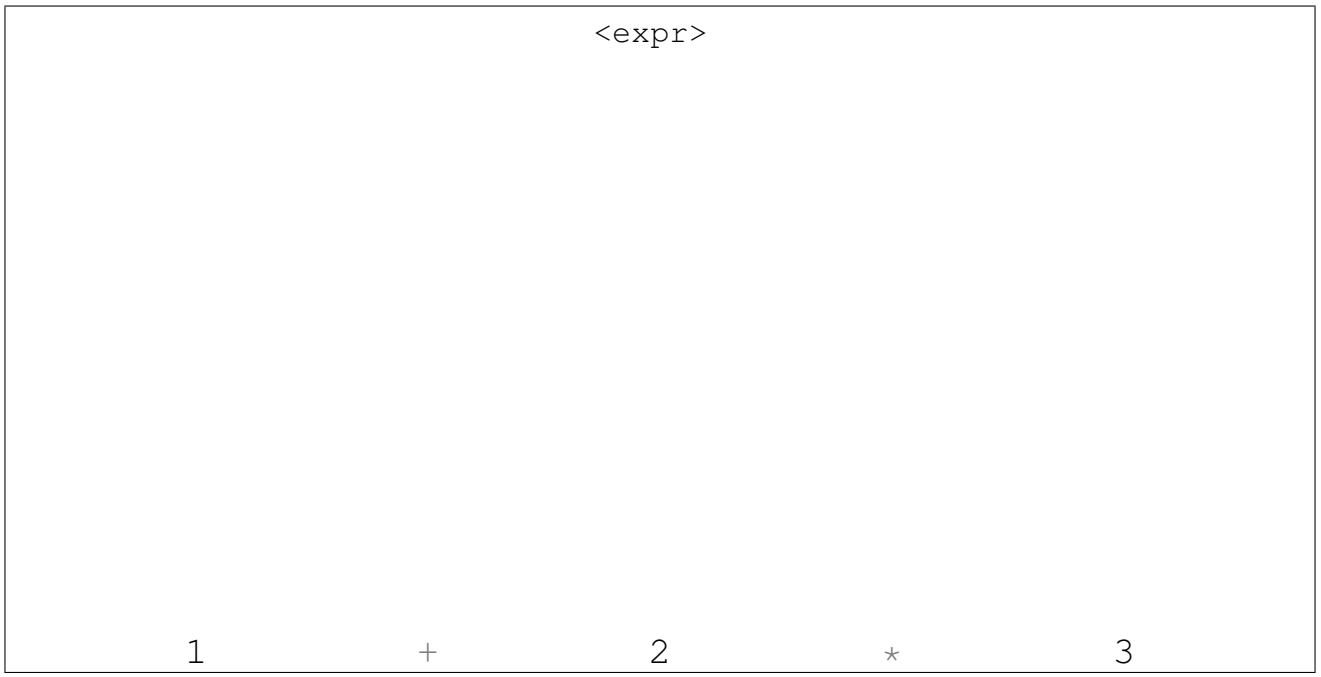
Computer Mathematics

Week 15 Examples

1. Using the following grammar

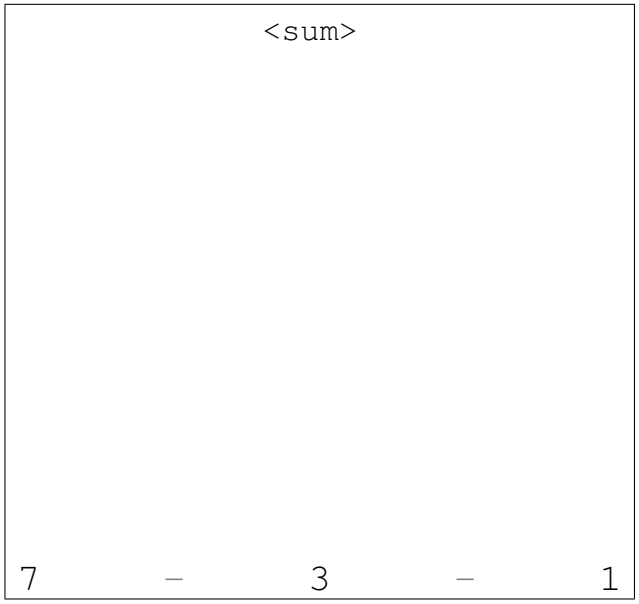
$$
\begin{aligned}
\langle expr \rangle &\rightarrow \langle expr \rangle \texttt{ + } \langle expr \rangle \\
&\mid \langle expr \rangle \texttt{ * } \langle expr \rangle \\
&\mid \langle number \rangle \\
\langle number \rangle &\rightarrow \texttt{0} \mid \texttt{1} \mid \texttt{...} \mid \texttt{8} \mid \texttt{9}
\end{aligned}
$$

write a derivation for the sentence: '1+2*3'

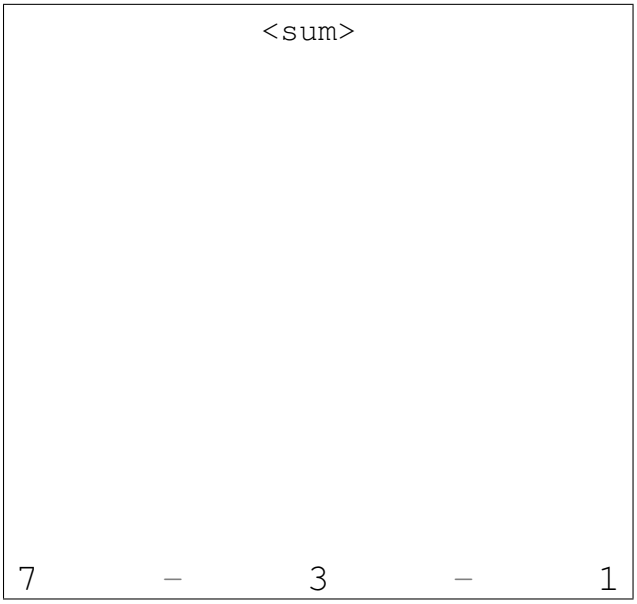


2. Using the following two grammars, write derivations for the sentence: '7 - 3 - 1'

$$
\begin{aligned}
\langle sum \rangle &\rightarrow \langle sum \rangle \texttt{ + } \langle number \rangle \\
&\mid \langle sum \rangle \texttt{ - } \langle number \rangle \\
&\mid \langle number \rangle \\
\langle number \rangle &\rightarrow \texttt{0} \mid \texttt{1} \mid \texttt{...} \mid \texttt{8} \mid \texttt{9}
\end{aligned}
$$



$$
\begin{aligned}
\langle sum \rangle &\rightarrow \langle number \rangle \texttt{ + } \langle sum \rangle \\
&\mid \langle number \rangle \texttt{ - } \langle sum \rangle \\
&\mid \langle number \rangle \\
\langle number \rangle &\rightarrow \texttt{0} \mid \texttt{1} \mid \texttt{...} \mid \texttt{8} \mid \texttt{9}
\end{aligned}
$$



3. Draw abstract syntax trees for the following expressions:

```
2*3+4
```

```
1+2*3+4
```

```
a < b or c < d
```

```
while a < b:  a = a * 2
```

4. Write an algorithm (an approximate outline of a function implementation) that could evaluate your ASTs.