1a.) $0^* 10^* \mid 0$

1b.)

The simple but “wrong” way:

$$([-+]?([1-9][0-9]+)|(0[0-7]+))(0[xX][0-9a-fA-F]+)$$

The “Valid” part requires us to only match numbers in the proper range. It’s impossible for C, since int literals are different depending on the architecture. But for Java and C if we assumed 32-bit, we might do:

$$0[xX][0-9a-fA-F]{,8}$$

1c.) /** this * is / */

* /

a comment ***

*/ but not here */

$\text{Star} = \backslash*$

$\text{CommentStart} = /\{\text{Star}\}$

$\text{CommentEnd} = \{\text{Star}\}/$

$\text{NotAStar} = [^\star]$

$\text{Newline} = [\backslash n]$

$\text{NotAStarOrSlash} = [^*/]$  

Ignoring the whitespace in the diagram below, this is what our regex will look like:

```
{CommentStart}
  |
  (NotAStar)
  |
  (Newline)
    |
    (Star)+
      |
      (NotAStarOrSlash)
      |
      (Newline)
    )
  )
{CommentEnd}
```
Yields:
/\*\([^*/\n]+\*\+\/*\|

Or JFlex will let you do:

"/\* ~ */"

2.) As a regex of fundamental operations: (b|ε)(ab)*bbb*

3.) DFA Start State = ε-closure(1) = \{1,2,3,5,6,7,10\} = A

<table>
<thead>
<tr>
<th>In state</th>
<th>See an a</th>
<th>See a b</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = {1,2,3,5,6,7,10}</td>
<td>{8} = B</td>
<td>{4,6,7,10,11} = C</td>
</tr>
<tr>
<td>B = {8}</td>
<td></td>
<td>{7,9,10} = D</td>
</tr>
<tr>
<td>C = {4,6,7,10,11}</td>
<td>{8} = B</td>
<td>{11,12,13,15} = E</td>
</tr>
<tr>
<td>D = {7,9,10}</td>
<td>{8} = B</td>
<td>{11} = F</td>
</tr>
<tr>
<td>E = {11,12,13,15}</td>
<td></td>
<td>{12,13,14,15} = G</td>
</tr>
<tr>
<td>F = {11}</td>
<td></td>
<td>{12,13,15} = H</td>
</tr>
<tr>
<td>G = {12,13,14,15}</td>
<td></td>
<td>{13,14,15} = I</td>
</tr>
<tr>
<td>H = {12,13,15}</td>
<td></td>
<td>{13,14,15} = I</td>
</tr>
<tr>
<td>I = {13,14,15}</td>
<td></td>
<td>{13,14,15} = I</td>
</tr>
</tbody>
</table>

4.)

A → a B | b C
B → b D
C → a B | b E
D → a B | b F
E → b G | ε

F → b H
G → b I | ε
H → b I | ε
I → b I | ε
5.) Without precedence:

\[ E \rightarrow E \&\& E \]

\[ E \rightarrow E \| \| E \]

\[ E \rightarrow ! E \]

\[ E \rightarrow \text{true} \]

\[ E \rightarrow \text{false} \]