Computer Architecture and Programming Languages
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Homework 11

Problem 11.1

Solution:

Total Instructions: 7

(a) Single Cycle:
We choose the longest path's timings and use it for all instructions. In this case, it is 800 ps.
$7 \times 800 = 5600$ ps.

Multi-cycle:
We use original time values for each of the instruction:
$2 \times 800 + 700 + 3 \times 600 + 500 = 4600$

To compare, we can calculate a ratio: 5600600 = 1.217

(b) As explained on Slide 30, the space left below the first instruction is a delay.

Instructions				Total
Load	Store	R-format	Branch	2600 ps
Delay = 800	Load	R-format		2200ps
Delay = 800	Delay = 800	R-format		2200ps

Again, we consider the largest time value i.e 2600 ps. To compare with single cycle approach, we can calculate a ratio:

5600/2600 = 2.154

(c) We calculate a ratio again:

4600/2600 = 1.769

Problem 11.2

Solution:

(a) $zero
Everything is read literally here.

(b) a[a-zA-Z0-9]*b
The characters a and b are read literally. The * above the bracket indicates that anything in the range mentioned in the bracket can occur any number of times (even 0). In the table, this is given as r*.

(c) [0-9][a-zA-Z0-9_]*[0-9]
It starts from a digit ranging from 0 to 9 and ends with one too. In between it can have any amount of alphabet, digits or underscores. (r*).

(d) (abb)a{4}[ab]{0,3}
(abb) is matched literally. a{4} matches the a character exactly 4 times. So far, we have 7 characters only and can only have 3 more. So when we write [a,b] to match any of the two characters, we give a range of {0,3} since we can have a maxmimum of 3 more characters now.

(e) [1-9]+[0-9]*
It has to start from 1. Then we can concatenate any number to it if the number has more than 1 digit.

(f) [-]?[1-9]+[0-9]*
r? suggests that there can be 0 or 1 negative signs.

(g) (pit|spot|spate|slap two|respite)
The pipe represents OR.

Problem 11.3

Solution:

(a) 1 and 3

(b) 1, 2 , 3, 4 ,6

(c) 3, 4,5

(d) 1,2,3,5