



Assign the point values you want for each problem. Any value from 0 to 4. They should add to 10.

1. (___ pts) Give a regular expression for all strings w on $\Sigma = \{a, b, c\}$ such that w starts with abc and ends with c .

♣ The only string with three letters that fits is abc . For all other strings, the c 's required are different letters, so $abc \cup abc(a \cup b \cup c)^*c$ works. ♣

2. (___ pts) Give a regular expression for all strings w on $\Sigma = \{a, b, c\}$ such that w does not start with abc .

♣ There are lots of ways for a string to fail to start abc . This is one way to organize to cover all cases:

First failure at the first letter: $(b \cup c)(a \cup b \cup c)^*$

First failure at the second letter: $a(a \cup c)(a \cup b \cup c)^*$

First failure at the third letter: $ab(a \cup b)(a \cup b \cup c)^*$

Or the word could just be too short: $(a \cup b \cup c \cup \lambda)^2$

So altogether: $((b \cup c) \cup a(a \cup c) \cup ab(a \cup b))(a \cup b \cup c)^* \cup (a \cup b \cup c \cup \lambda)^2$ ♣

3. (___ pts) In the string $abcbaccbb$, the letter c occurs in the third and seventh position. Give a regular expression for all strings w on $\Sigma = \{a, b, c\}$ such that there is at least one c in an odd position.

♣ We group in pairs, c is in an odd position if it comes first in its pair. So there are no c 's in odd position in this string of pairs: $[(a \cup b)(a \cup b \cup c)]^*$.

Then comes a c , the first c in an odd position, then anything you like: $c(a \cup b \cup c)^*$.

So altogether: $[(a \cup b)(a \cup b \cup c)]^*c(a \cup b \cup c)^*$ ♣

4. (___ pts) Give a regular expression for all strings w on $\Sigma = \{a, b, c\}$ such that there is exactly one c in an odd position.

♣ It starts as before, but the pairs which follow cannot end in c : $[(a \cup b \cup c)(a \cup b)]^*$.

And there could be a final letter or not, it is not an odd position, so c is ok.

So altogether: $[(a \cup b)(a \cup b \cup c)]^*c[(a \cup b \cup c)(a \cup b)]^*(a \cup b \cup c \cup \lambda)$ ♣

5. (___ pts) Give a regular expression for all strings w on $\Sigma = \{a, b, c\}$ of length 101 such that a does not occur in the first 20 characters, and c does not occur in the last 20 characters.

♣ Using exponents, which in a regular expression must be constants, this is not hard at all.

The first 20 characters: $(b \cup c)^{20}$.

The final 20 characters: $(a \cup b)^{20}$.

The middle 61 characters: $(a \cup b)^{61}$

So altogether: $(b \cup c)^{20}(a \cup b)^{61}(a \cup b)^{20}$. ♣