Fun question

This question is intended to help you practice counting things. In the Arthur C. Clarke short story *The Nine Billion Names of God* a 'Mark V Automatic Sequence Computer' is purchased by a religious community to list all the possible names of their deity, a task whose importance is central to their belief system. We are told that this name is nine or fewer characters long and that no characters can occur more than three times in sequence, so AABBAABBA is a possible name, as is AAABBAABB, but AAAABBAAB is not (see note below). We are not told in the story how many characters the alphabet contains but for definiteness lets assume there are 18 letters in the alphabet. Show how you could calculated how many names there are with n; in other words, describe a method for calculating the number of names of up to length n and use this method to calculate the number of names of length nine.

Note from the Arthur C Clarke story

The restriction permits letters to repeat three times but not four may seem surprising, this is noted in the story

> '[W]e use a special alphabet of our own. Modifying the electromatic typewriters to deal with this is, of course, trivial. A rather more interesting problem is that of devising suitable circuits to eliminate ridiculous combinations. For example, no letter must occur more than three times in succession.'
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> 'Three? Surely you mean two.'
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> 'Three is correct: I am afraid it would take too long to explain why, even if you understood our language.'