String manipulation

Algorithms and programming (Paper 2) · revision notes

String manipulation means working with text: finding its length, taking part of it, changing its case, joining strings and converting between characters and their ASCII codes. Expect 'state the result' questions and short programs that loop through the characters of a string.

Key facts

- word.length: number of characters
- word.left(n) / word.right(n): first / last n characters
- ASC("A") = 65; CHR(65) = "A"; ASC("a") = 97
- Every character: for i = 0 to word.length - 1 … word.substring(i, 1)
- word.substring(start, n): n characters from position start (first position = 0)
- word.upper / word.lower: change the case
- Concatenate with +; cast numbers with str() first

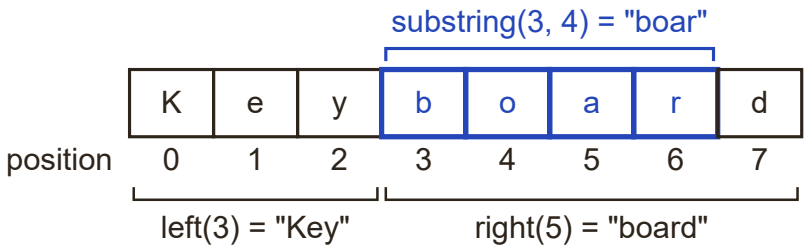
Notes

String operations in ERL

- `word.length`: the number of characters in the string.
- `word.substring(start, n)`: n characters, starting at position start. The first character is at position **0**. Taking part of a string like this is called **slicing**.
- `word.left(n)` and `word.right(n)`: the first n or last n characters.
- `word.upper` and `word.lower`: the string in upper or lower case.
- Concatenation: join strings with `+`. Cast numbers first: `"Level " + str(3)` gives "Level 3".

Worked example: word = "Keyboard"

- Positions: K is 0, e is 1, y is 2, b is 3, o is 4, a is 5, r is 6, d is 7.



Positions start at 0: substring(3, 4) takes 4 characters starting at position 3

- `word.length` gives 8.
- `word.substring(3, 4)` gives "boar" (4 characters from position 3).
- `word.left(3)` gives "Key" and `word.right(5)` gives "board".
- `word.upper` gives "KEYBOARD".

Character codes

- `ASC(ch)` gives the character code (ASCII) of a character: `ASC("A")` is 65 and `ASC("a")` is 97.
- `CHR(code)` gives the character for a code: `CHR(66)` is "B".
- Letters have consecutive codes, so `CHR(ASC("C") + 2)` gives "E".

Looping through a string

- To check every character, loop from 0 to length − 1 and take one character at a time:

```
spaces = 0
for i = 0 to sentence.length - 1
   if sentence.substring(i, 1) == " " then
      spaces = spaces + 1
   endif
next i
```

How to answer each type of question

State the result of string operations

1 mark each | Grade 5

1. Write the string out and number the positions from 0.
2. For substring, start at the given position and count n characters.
3. Give text results in quotation marks and numbers without them.

Example. `city = "Manchester"`
State the result of:
(a) city.length (b) city.substring(3, 4) (c) city.upper (d) city.right(4) (e) CHR(ASC("C") + 2) [5]

Model answer.

(a) 10	(1)
(b) "ches"	(1)
(c) "MANCHESTER"	(1)
(d) "ster"	(1)
(e) "E"	(1)

Write code that builds a string

3 to 4 marks | Grade 6

1. Input the data you need.
2. Use substring, left or right to take the part you need.
3. Change the case if asked, then join the parts with +.
4. Output (or return) the result.

Example. A username is the first three letters of a surname in upper case, followed by the year of birth. For example, Patel born in 2009 has the username PAT2009.
Write a program that inputs a surname and a year of birth and outputs the username. [4]

Model answer.

```
surname = input("Enter surname")
year = input("Enter year of birth")
first3 = surname.left(3)
username = first3.upper + year
print(username)
```

Inputs the surname and the year (1); takes the first three characters, using left(3) or substring(0, 3) (1); converts them to upper case (1); joins them to the year and outputs the result (1).

Write a function that loops through a string

4 to 5 marks **Grade 8**

1. Set a counter to 0.
2. Loop from 0 to length − 1, taking one character each time.
3. Test the character, using OR for several possible matches.
4. Return (or output) the result after the loop.

Example. Write a function `countVowels(word)` that returns the number of vowels (a, e, i, o, u) in `word`. The word is in lower case. [5]

Model answer.

```
function countVowels(word)
   count = 0
   for i = 0 to word.length - 1
      letter = word.substring(i, 1)
      if letter == "a" OR letter == "e" OR
         letter == "i" OR letter == "o" OR
         letter == "u" then
         count = count + 1
      endif
   next i
   return count
endfunction
```

Loops through every character, 0 to length − 1 (1); takes one character at a time (1); checks it against all five vowels with OR (1); adds 1 to a count set to 0 before the loop (1); returns the count after the loop (1).

Don’t lose marks

- Counting positions from 1 instead of 0.
- Treating the second value in substring as an end position.
- Looping to word.length instead of word.length − 1, which goes past the last character.
- Joining a number to a string without casting it with str().
- Writing `letter == "a" OR "e"` instead of repeating the comparison each time.

More tips

Memory tricks

- Positions start at 0, so the last character is at position length − 1.
- substring(start, n): the second number is HOW MANY characters, not where to stop.
- You only need two codes: A = 65 and a = 97. The other letters follow in order, so B = 66, C = 67, b = 98 and so on.

Exam technique

- Write the string out with its position numbers underneath before answering.
- If the question defines how a string function works, use that definition exactly.
- Use the variable and function names given in the question.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4 — **Join strings together (concatenation)**
Use + to join strings, casting numbers with str() first.

Grade 5 — **Use length, upper and lower**
word.length gives the number of characters; .upper and .lower change the case.

Grade 5 — **Extract part of a string**
Use .substring(start, n), .left(n) and .right(n), counting positions from 0.

Grade 6 — **Use ASC and CHR**
ASC("A") gives the character code 65; CHR(66) gives "B".

Grade 7 — **Loop through each character of a string**
Use for i = 0 to word.length - 1 with word.substring(i, 1).

Grade 8 — **Write functions that process strings**
For example count vowels, check a password's characters or build a code.

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