OS'21: Assignment 2

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## Important Instructions

Please read instructions carefully, any mistake or error may result in assignment rejection from the automated grading system:

1. Make sure to start solving assignment2 using the **assignment2 startup** code.
2. Open the “FOS\_Assignment\_Template” project from the left panel of the eclipse
3. Copy and replace the **five files** from the assignment folder into " FOS\_Assignment\_Template \kern\". [REMEMBER to take a copy the old assignment files if you want]
4. During your solution, make sure that you **DON'T CHANGE** any other file rather than command\_prompt.c/.h
5. Your code *MUST* be written inside the given function for each question (as specified [below](#_Questions)).

**ANY violation to this rule, or change of function names, or deletion of template functions may result in assignment rejection by the automated grading system.**

1. Make sure that your code *PASS* the **automatic tests** in the following **TWO MODES**:
2. Running **ALL** test cases together (default test)
3. Run the test case of each question **alone** by commenting all other tests and leave one test only, and repeat this for each question. (Tests calls inside "kern\tests.c" in function "TestAssignment2()"
4. Assignments *MUST* be delivered using this online form: <https://forms.gle/twssNJWrFdixTiL2A>
5. If you face a problem in **RE-submitting** the assignment code, kindly follow [these steps](https://cisasuedu-my.sharepoint.com/personal/ahmed_salah_cis_asu_edu_eg/Documents/E-Learning%202021/%5bOS'21%5d%20Materials/Staff%20Only/%5b3%5d%20ASSIGNMENTS/%5bOS'21%5d%20Assignment2/Resubmission%20Issue%20Solution.txt) [Resubmission ONLY]
6. For any question/problem, don’t miss the [weekly office hours](https://docs.google.com/spreadsheets/d/1jGlGhV7GELCLMmEvKP70th4bnArE-GVhLwTGl4EmHtc/edit?usp=sharing)

## Delivery Method & Dates

* **Assignment & Bonus:** through the above online form
  + **Early delivery (main questions):** FRI 5 November 23:59
  + **Final delivery (main questions + bonus):** FRI 12 November 23:59
* **Challenge:** During the office hours till THU 18 November

## Questions

Add the following commands to the Kernel:

### Create Named String

#### Name:

cns <string name> <string value>

#### Description:

* This command should create a string (array of characters) with the given name and initialize it with the provided value, followed by a null character ‘\0’.
* It should return the **start virtual address of the FIRST ELEMENT** in allocated string.
* The allocation should start initially from the virtual address **0xF1000000**, and then **continue allocating** after this address.
* MAX number of strings to be created is 30.
* The string value doesn’t contain space characters.
* If the string name matches with a previously created string. The command returns NULL and doesn’t create a new string.

#### Example:

**FOS>** **cns** x Hello //allocate string x of size 5 and initialize it by “Hello”

// (starting from **0xF100000**)

**FOS>** **cns** str abcd //allocate string str of size 4 after the string x and initialize it by “abcd”

// (starting from **0xF100006**)

**FOS>** **cns** str2 os //allocate string str2 of size 2 after the string str and initialize it by “os”

// (starting from **0xF10000B**)

#### Function:

Your code MUST be written inside the following function:

**char\* CreateString(char\*\* arguments)**

* + arguments[1]: string name
  + arguments[2]: string value
  + **Return:** start address of the **FIRST ELEMENT** in the created string. Or **NULL** if the string already exists.

#### Helper Functions:

**strcpy(**char \*dst, const char \*src): to copy string from src to dst

***Hint*: strcpy** *should be used to copy the string name, not the string value.*

**strlen**(const char \*s): to get the length of a char array

### Get a String Size

#### Name:

gss <string name>

#### Description:

* This command should return the size of the string named <string name>.
* If there is no string with the given name. The function should return -1.

#### Example:

**FOS>** cns x Hello

**FOS>** cns y Thanks

**FOS>** **gss** x //should return 5 (the size of “Hello”)

**FOS>** **gss** y//should return 6 (the size of “Thanks”)

**FOS>** **gss** z //should return -1 (no string named z)

#### Function:

Your code MUST be written inside the following function:

**int GetStringSize(char\*\* arguments)**

* + arguments[1]: name of the string

**Return:** the size of the string if it exists. Or -1 if it doesn’t exist.

#### Helper Functions:

* int strcmp(const char \*p, const char \*q): to compare string p to string q

### Find a Substring

#### Name:

fss <string name> <substring>

#### Description:

* This command should search for the <substring> inside the string <string name> and return the index of the FIRST occurrence of this item
* If <string name> exists and <substring> is found, the command should return the **zero-based** index of its FIRST occurrence.
* Otherwise return -1.

#### Example:

**FOS>** cns s1 Hello

**FOS>** cns s2 Thanks

**FOS>** cns s3 curriculum

**FOS>** **fss** s1 el //should return 1

**FOS>** **fss** s3 cu //should return 0 (the index of the first occurrence of cu)

**FOS>** **fss** s2 ah//should return -1 (s2 doesn’t contain “ah” as a substring)

**FOS>** **fss** z or//should return -1 (z doesn’t exist)

#### Function:

Your code MUST be written inside the following function:

**int FindSubstring(char\*\* arguments)**

* + arguments[1]: string name
  + arguments[2]: search key to search for

**Return**

* + If search key is found: return the zero-based index of its first occurrence
  + Otherwise: return -1

### Swap Two Strings

#### Name:

swap <string1 name> <string2 name>

#### Description:

* This command should swap the values of the given two strings (exchange their values).
* String1 and string2 would always be **EQUAL SIZED** (have the same number of characters)
* Strings should exchange their values, not their names

#### Ex:

**FOS>** cns x1 “hello” //allocate string "x1" of size 5 starting from **0xF1000000**

**FOS>** cns y1 “cat” //allocate string "y1" of size 3 from **0xF1000006**

**FOS>** cns z1 “white” //allocate string "z1" of size 5 from **0xF100000A**

**FOS>** cns str “big” //allocate string "str" of size 3 starting from **0xF1000010**

**FOS>** **swap** x1 z1 // x1 should have the value “white”

//starting from **0xF1000000**

//z1 should have the value “hello”

//starting from **0xF100000A**

**FOS>** **swap** str y1 // y1 should have the value “big” starting from **0xF1000006**

// str should have the value “cat” starting from **0xF1000010**

#### Function:

Your code MUST be written inside the following function:

**void SwapStrings(char\*\* arguments)**

* + arguments[1]: name of the first string
  + arguments[2]: name of the second string to swap

## BONUS [2 MARKS]

### Concatenate Strings

#### Name:

cat <string1> <string2>

#### Description:

* This command should concatenate the string named <string2> to the string named <string1>
* If <string1> or <string2> doesn’t exist, you should do nothing

#### Example:

**FOS>** cns str1 mid

**FOS>** cns str2 night

**FOS>** **cat** str1 str2 //after this line: str1=”midnight”, str2 = “night”

#### Function:

Your code MUST be written inside the following function:

**void Concatenate(char\*\* arguments)**

* + arguments[1]: string1 name
  + arguments[2]: string2 name

## CHALLENGE [5 MARKS]!!!

Change the FOS Virtual Space

Change the start location of the FOS virtual space to be @ address 0 instead of KERNEL\_BASE

After this, address *N* in the virtual memory should be mapped to address *N* in the physical RAM

**MAKE SURE that you followed the above instructions carefully. Good Luck isA J**