CS205 C/ C++ Programming Assignment5

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Part 1 – Analysis

This Assignment first requires us compile C and C++ together, and the assignment paper have already told us how to rewrite the header file.

Part1:

Then we need to write length(), bytes(), find(string substr), replace(UTF8string to_remove, UTF8string replacement) four functions.

1. length(): We can use the function "utf8_to_codepoint" in utf8.h to count the length of the UTF8string.
2. bytes(): We can observe the method ".length()" of string class can return byte of a string. So we can use it directly.
3. find(string substr): First, we can use ".find()" in string class to find whether the substring is in the string or not. If we did not find, that means there is no such substring in the string. If we find, the position ".find()" in string class returns means how many bytes before the substring, so we use "utf8_to_codepoint" again to find the exact position.(However, this method can only find one position, so the return position is where we first find the substring)
4. replace(UTF8string to_remove, UTF8string replacement): We use find method we designed before to find the substring, replace them until we can't find such substring.

Part2:

This part is asking us to redefine some operators.

1. << : Since we need to output other things at the same time, so we use friend function to redefine it. Since it will not modify the object of UTF8string, we can define it as a const function.
2. + : Since it will not modify the object of UTF8string, we can define it as a const function. We need to add two objects, and return a new one. So we need to return a copy of the new object.
3. +=: Since we need to modified one of the object, so we write it as a class function.
4. *: Without changing the origin string, we need to repeat it many times. Since the input n can be any integer, we use for loop to deal with it. We need to redefine two kinds of function since 2*u and u*2 are both valid.
5. !: It is an operator acting on only one object without modifying it, so we write the redefine function as a class function. And in the new string, we need to append one character after a character before it.

Part 2 – Code

.hpp file

```
#ifndef ASSIGNMENT_5_UTF8STRING_HPP
#define ASSIGNMENT_5_UTF8STRING_HPP
```

```
#include <string>


class UTF8string {
private:
    std::string str;

public:
    UTF8string(std::string s);

    UTF8string(char s[]);

    UTF8string();

    size_t length() const;

    size_t bytes() const;

    long find(std::string substr) const;

    void replace(UTF8string to_remove, UTF8string replacement);

    std::string getStr() const;

    friend std::ostream &operator<<(std::ostream &os, const UTF8string &s);

    friend UTF8string operator+(const UTF8string &s1, const UTF8string &s2);

    friend void operator+=(UTF8string &s1, const UTF8string &s2);

    friend UTF8string operator*(const UTF8string &s, int time);

    friend UTF8string operator*(int time, const UTF8string &s);

    UTF8string operator!() const;

};


#endif //ASSIGNMENT_5_UTF8STRING_HPP
```

.cpp file

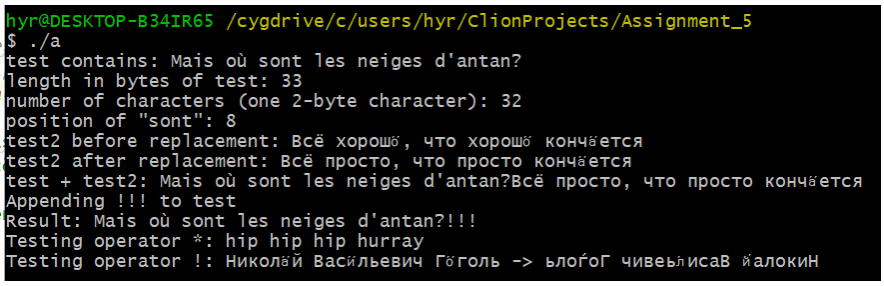
```cpp
#include "UTF8string.hpp"
#include <cstring>
#include <string>
#include "utf8.h"

#include <iostream>

using namespace std;

string UTF8string::getStr() const {
	return str;
}

UTF8string::UTF8string(string s) {
	str = s;
}

UTF8string::UTF8string() {
	str = "";
}

UTF8string::UTF8string(char s[]) {
	str = string(s);
}

size_t UTF8string::length() const {
	char const *input = str.c_str();
	unsigned long codepoint;
	int bytes_in_char;
	size_t length = 0;

	unsigned char *p;
	p = (unsigned char *) (&input[0]);
	while (*p) {
		codepoint = utf8_to_codepoint(p, &bytes_in_char);
		if (codepoint) {
			length++;
			_utf8_incr(p);
		} else {
			p++;
		}
	}
	return length;
}
```

```
size_t UTF8string::bytes() const {
	return str.length();

}

long UTF8string::find(string substr) const {
	long find = str.find(substr);
	if (find == string::npos)
		return find;//not find

	char const *input = str.substr(0,find).c_str();
	unsigned long codepoint;
	int bytes_in_char;
	unsigned long result = 0;

	unsigned char *p;
	p = (unsigned char *) (&input[0]);
	while (*p) {
		codepoint = utf8_to_codepoint(p, &bytes_in_char);
		if (codepoint) {
			result++;
		}
		_utf8_incr(p);
	}
	return result;

}

void UTF8string::replace(UTF8string to_remove, UTF8string replacement) {
	while (str.find(to_remove.getStr()) != string::npos)
		str = str.replace(str.find(to_remove.getStr()), to_remove.bytes(), replacement.getStr());
	return;
}

ostream &operator<<(ostream &os, const UTF8string &s) {
	return os << s.str;
}

UTF8string operator+(const UTF8string &s1, const UTF8string &s2) {
	UTF8string u(s1.str + s2.str);
	return u;
}
```

```
void operator+=(UTF8string &s1, const UTF8string &s2) {
    s1.str = s1.str + s2.str;
}


UTF8string operator*(const UTF8string &s, int time) {//if time<0,it will return "".
    UTF8string u;
    for (int i = 1; i <= time; i++) {
        u.str = u.str + s.str;
    }
    return u;
}

UTF8string operator*(int time, const UTF8string &s) {
    return s * time;
}

UTF8string UTF8string::operator!() const {
    char const *input = str.c_str();
    string result = "";
    int bytes_in_char;
    unsigned long codepoint;

    unsigned char *p;
    p = (unsigned char *) (&input[0]);
    while (*p) {
        codepoint = utf8_to_codepoint(p, &bytes_in_char);
        if (codepoint) {
            string block = "";
            for (int i = 0; i < bytes_in_char; ++i) {
                block += p[i];
            }
            result = block + result;
            p += bytes_in_char;
        } else {
            p++;
        }
    }
    UTF8string resultUTF8(string);
    return result;
}
```

Part 3 - Result & Verification

Test program on sakai:



It is the same as the given result.

Part 4 - Difficulties & Solutions

1. First, I use an array of char to inverse a string. However, blanks are garbled. Finally I gave up using C-style string and used the string in C++. Although it is not quick, it works.
2. First I do not know how to redefine "<<" correctly, so I read the textbook and get the right answer.