CS205 C/ C++ Programming_Assignment3

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Part 1. Split String

- ### Analysis

  For struct Pair, I use the simplest single char to store the value. I think there is no need to use pointer or array here.

  The printPair function can be easily achieve by using cout.

  The splitPair function is a bit confused, the **length of pair array depends on the result of s.size() % 4.**

  For example the string "121234" should be {1,1},{2,2} after using function split Pair.

  If s.size() % 4 == 2, the length of pair array should be (s.size() / 2) - 1, else the length should be s.size() / 2.

  Here I use a ternary operator to simplify the code.

  Then I go through the string to add all the possible pair to the array.

- ### Code

```
struct Pair {
    char l, r;
};
```

```
Pair* splitPair(string s, int& length) {
    int len = s.size();
    length = (len % 4 == 2) ? len / 2 - 1 : len / 2;
    Pair* arr = new Pair[length];
    int count = 0;
    for (size_t i = 0; i + 2 < len; i += 4) {
        Pair p;
        p.l = s.at(i);
        p.r = s.at(i + 2);
        *(arr + count++) = p;
        if (i + 3 >= len) {
            break;
        } else {
            Pair p2;
            p2.l = s.at(i + 1);
            p2.r = s.at(i + 3);
            *(arr + count++) = p2;
        }
    }
    return arr;
}

void printPair(Pair* pair) {
    cout << pair->l << " " << pair->r << endl;
}
```

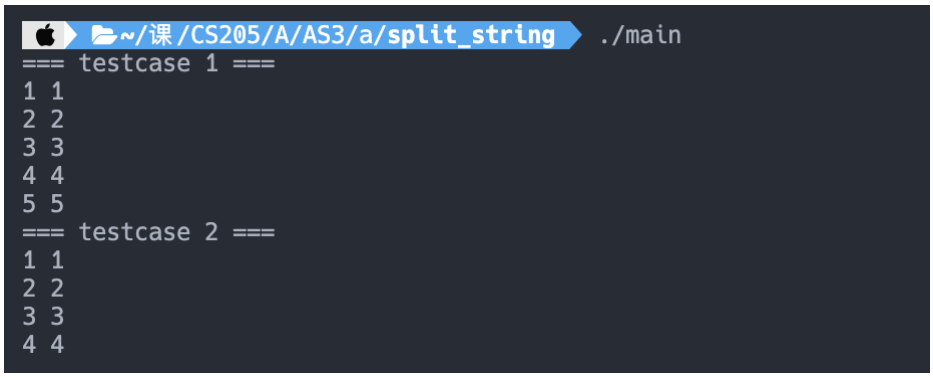
```
CC = clang++
LIB = $(LIB_DIR)/pair.so
TARGET = main
CFLAGES = -std=c++17 -stdlib=libc++ -c -Wall
OBJ = main.cpp
LIB_DIR = ./lib


$(TARGET) : $(OBJ) $(LIB)
    $(CC) -o $@ -L. $(OBJ) $(LIB)

$(LIB_DIR)/pair.so : pair.cpp
    mkdir -p $(LIB_DIR)
    $(CC) -shared -fPIC -o $(LIB) pair.cpp

clean:
    rm -f *.o $(TARGET) $(LIB)
    rmdir $(LIB_DIR)
```

- ## Result & Verification



- ## Difficulties & Solutions

  Writing the make file is a bit hard for me, I am not good at writing makefile

Part 2.

- ## Analysis

  Using the default arguments we can easily finish task 1&2, setting the default value to 1.

  The const char* and string can't be compared with a >, so the template specialization is needed.

- ## Code

```
inline int product(int a, int b, int c = 1, int d = 1, int e = 1) {
    return a * b * c * d * e;
}

inline double product(double a, double b, double c = 1, double d = 1, double e = 1) {
    return a * b * c * d * e;
}
```

```cpp
template <typename T>
inline T bigger(T const a, T const b) {
    return a > b ? a : b;
}

template <>
inline const char* bigger<const char*>(const char* a, const char* b) {
    return strlen(a) > strlen(b) ? a : b;
}

template <>
inline std::string bigger<std::string>(const std::string a, const std::string b) {
    return a.length() > b.length() ? a : b;
}
```

```cmake
cmake_minimum_required(VERSION 3.0)

project(bigger_product)

add_executable(main_bigger main_bigger.cpp)

add_executable(main_product main_product.cpp)
```

- **Result & Verification**

```
~/课/CS205/A/AS3/a/product_and_bigger ./main_bigger
=== test int ===
2
=== test double ===
2.5
=== test const char* ===
ab
=== test string ===
ab

~/课/CS205/A/AS3/a/product_and_bigger ./main_product
=== test product of int ===
2
6
24
120
=== test product of double ===
0.8
2.4
9.6
48
```

- **Difficulties & Solutions**

  It take me a while to deal with compile erro in OJ because I didn't write

  #include

  #include

Part 3.

- **Analysis**

It's a recursive function, the base case is row == 0, each time return pascal(row - 1, column) + pascal(row - 1, column - 1)

- ## Code

```
int pascal(int row, int column) {
    if (row == 0) {
        if (column == 0) {
            return 1;
        } else {
            return 0;
        }
    } else {
        return (pascal(row - 1, column) + pascal(row - 1, column - 1));
    }
}
```

- ## Result & Verification

```
~/课件/CS205_C++/Assignment/AS3/assignment3/pascal_triangle g++ main.cpp pascal.cpp -o main && ./main
pascal(0,0) = 1
pascal(0,5) = 0
pascal(3,2) = 3
pascal(4,2) = 6
pascal(5,3) = 10
pascal(7,3) = 35
```

- ## Difficulties & Solutions

None

Part 4.

- ## Analysis

csv file is well arranged.It is easy to judge whether the country name of each row is "China"(judge the word between the second and third comma). Because I am not sure that whether there exist a city, province or state call China(or contain), I write a function to judge whther the string have "China" between the second and the third comma and avoid the index out of bound error. Therefore the execution logic of the program is to read every lines in the world_cities.csv and judge whther it's in China, if so we write this line to the china_cities.csv.

How to run

I write a cmakelists, use cmake to bulid the program.

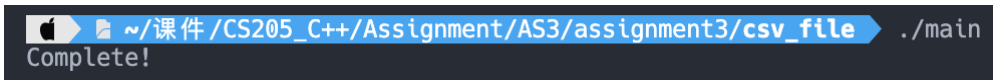
- ## Code

```
void generate(const char* dir) {
    ifstream infile;
    ofstream outfile;
    infile.open(dir);
    outfile.open("china_cities.csv");
    string line;
    while (infile >> line) {
        if (china(line)) {
```

```
            outfile << line << endl;
        }
    }
    infile.close();
    outfile.close();
}

bool china(string line) {
    int l = 0;
    int cnt = 0;
    for (size_t i = 0; i < line.length(); i++) {
        if (line.at(l++) == ',') {
            if (cnt++ == 1) {
                break;
            }
        }
    }
    if (l + 5 >= line.length()) {
        return false;
    } else {
        return line.substr(l, 5).compare(string("China")) == 0;
    }
}
```

- **Result & Verification**



```
Beijing,,China,39.900,116.400
Changchun,Jilin,China,43.900,125.200
Chengdu,Sichuan,China,30.667,41.000
Chongqing,,China,29.567,106.567
Dalian,Liaoning,China,38.917,121.633
Dongguan,Guangdong,China,23.033,113.717
Gaoxiong,Taiwan,China,22.633,120.267
Guangzhou,Guangdong,China,23.133,113.267
Handan,Hebei,China,36.600,114.483
Hangzhou,Zhejiang,China,30.250,120.167
Harbin,Heilongjiang,China,45.750,126.633
Jinan,Shandong,China,36.667,116.983
Kunming,Yunnan,China,25.067,102.683
Lanzhou,Gansu,China,36.033,103.800
Lhasa,Tibet,China,29.650,91.100
Macau,Macau,China,22.167,113.550
Nanjing,Jiangsu,China,32.050,118.767
Nanning,Guangxi,China,22.817,108.317
Qingdao,Shandong,China,36.067,120.383
Qiqihar,Heilongjiang,China,47.433,123.450
Shanghai,,China,31.200,121.500
Shenyang,Liaoning,China,41.817,123.417
Shenzhen,Guangdong,China,22.550,114.100
Shigatse,Tibet,China,29.267,88.883
Shijiazhuang,Hebei,China,38.050,114.500
Taibei,Taiwan,China,25.033,121.633
Tainan,Taiwan,China,22.983,120.183
Taiyuan,Shanxi,China,37.867,112.567
Taizhong,Taiwan,China,24.150,120.667
Tianjin,,China,39.133,117.183
Wuhan,Hubei,China,30.583,114.283
```

Part of the file

- ## Difficulties & Solutions

  None