

LAB REPORT

COMPUTER ARCHITECTURE

Lab 2

Branches and procedures

Student Name: Biện Công Thanh

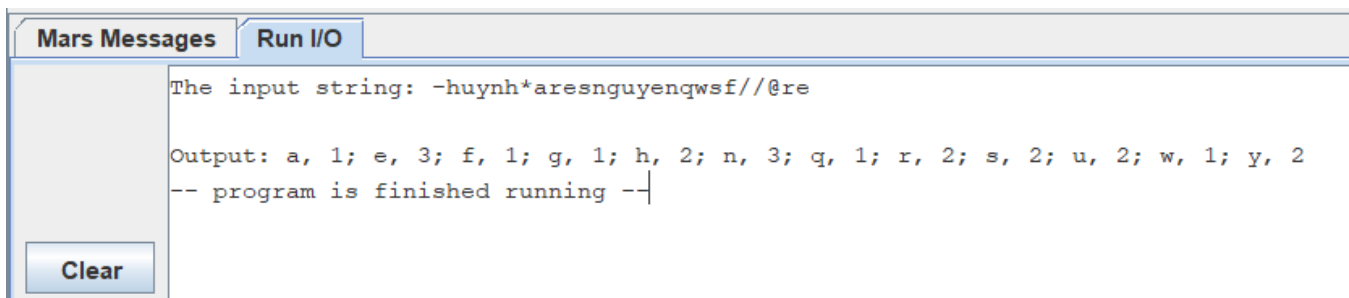
Student ID: 2053424

Group: CC11

Exercise 1:

+ **Test 1:** -huynh*aresnguyenqwsf//@re

-> **Output:** a, 1; e, 3; f, 1; g, 1; h, 2; n, 3; q, 1; r, 2; s, 2; u, 2; w, 1; y, 2



The screenshot shows a window titled "Mars Messages" with a "Run I/O" button. The text area contains the following output:

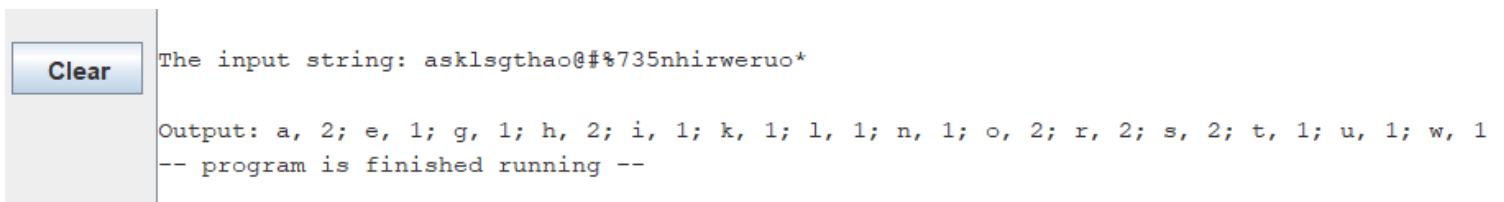
```
The input string: -huynh*aresnguyenqwsf//@re

Output: a, 1; e, 3; f, 1; g, 1; h, 2; n, 3; q, 1; r, 2; s, 2; u, 2; w, 1; y, 2
-- program is finished running --
```

A "Clear" button is located at the bottom left of the text area.

+ **Test 2:** asklsgthao@#%735nhirweruo*

-> **Output:** a, 2; e, 1; g, 1; h, 2; i, 1; k, 1; l, 1; n, 1; o, 2; r, 2; s, 2; t, 1; u, 1; w, 1



The screenshot shows a window titled "Mars Messages" with a "Run I/O" button. The text area contains the following output:

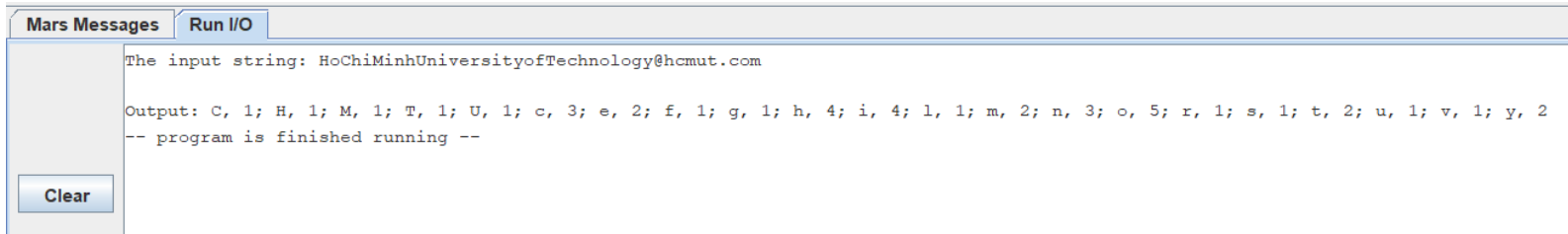
```
The input string: asklsgthao@#%735nhirweruo*

Output: a, 2; e, 1; g, 1; h, 2; i, 1; k, 1; l, 1; n, 1; o, 2; r, 2; s, 2; t, 1; u, 1; w, 1
-- program is finished running --
```

A "Clear" button is located at the bottom left of the text area.

+ Test 3: HoChiMinhUniversityofTechnology@hcmut.com

-> Output: C, 1; H, 1; M, 1; T, 1; U, 1; c, 3; e, 2; f, 1; g, 1; h, 4; i, 4; l, 1; m, 2; n, 3; o, 5; r, 1; s, 1; t, 2; u, 1; v, 1; y, 2



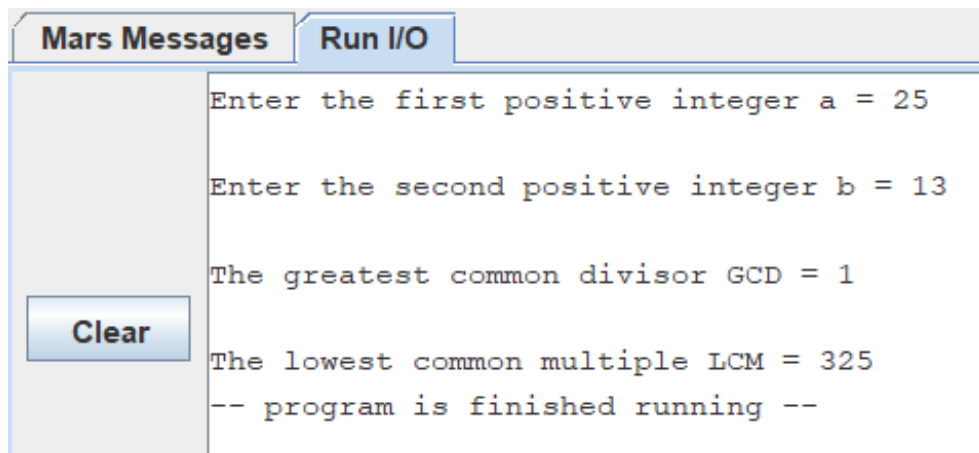
The screenshot shows a 'Mars Messages' window with a 'Run I/O' tab. The text area contains the following output: 'The input string: HoChiMinhUniversityofTechnology@hcmut.com', 'Output: C, 1; H, 1; M, 1; T, 1; U, 1; c, 3; e, 2; f, 1; g, 1; h, 4; i, 4; l, 1; m, 2; n, 3; o, 5; r, 1; s, 1; t, 2; u, 1; v, 1; y, 2', and '-- program is finished running --'. A 'Clear' button is located at the bottom left of the text area.

```
Mars Messages Run I/O
The input string: HoChiMinhUniversityofTechnology@hcmut.com
Output: C, 1; H, 1; M, 1; T, 1; U, 1; c, 3; e, 2; f, 1; g, 1; h, 4; i, 4; l, 1; m, 2; n, 3; o, 5; r, 1; s, 1; t, 2; u, 1; v, 1; y, 2
-- program is finished running --
Clear
```

Exercise 2:

+ Test 1: a = 25, b = 13

-> Output: GCD = 1, LCM = 325

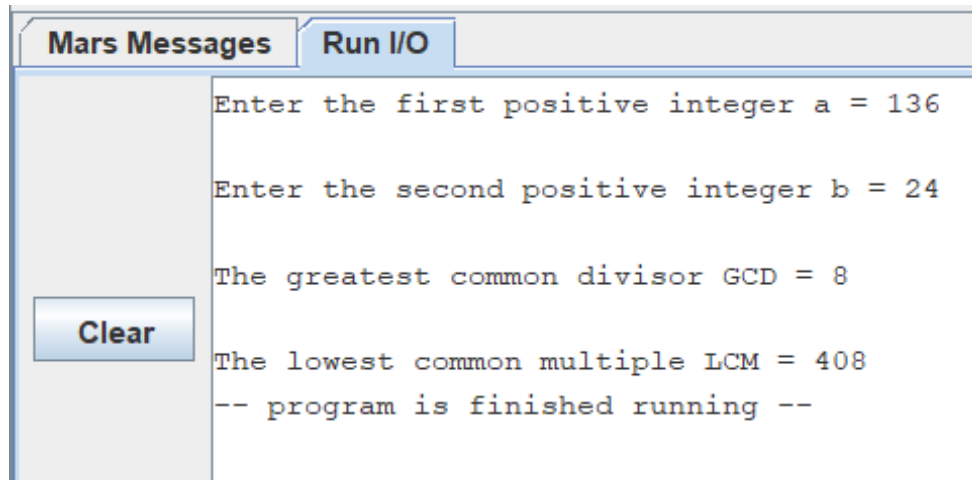


The screenshot shows a 'Mars Messages' window with a 'Run I/O' tab. The text area contains the following output: 'Enter the first positive integer a = 25', 'Enter the second positive integer b = 13', 'The greatest common divisor GCD = 1', 'The lowest common multiple LCM = 325', and '-- program is finished running --'. A 'Clear' button is located on the left side of the text area.

```
Mars Messages Run I/O
Enter the first positive integer a = 25
Enter the second positive integer b = 13
The greatest common divisor GCD = 1
The lowest common multiple LCM = 325
-- program is finished running --
Clear
```

+ **Test 2:** $a = 136$, $b = 24$

-> **Output:** $\text{GCD} = 8$, $\text{LCM} = 408$



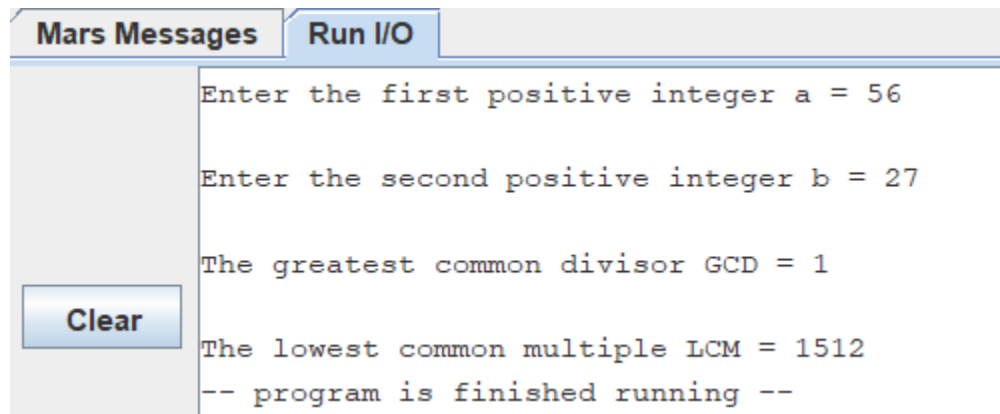
The screenshot shows a window titled "Mars Messages" with a "Run I/O" button. The text area contains the following output:

```
Enter the first positive integer a = 136  
Enter the second positive integer b = 24  
  
The greatest common divisor GCD = 8  
  
The lowest common multiple LCM = 408  
-- program is finished running --
```

A "Clear" button is visible on the left side of the text area.

+ **Test 3:** $a = 56$, $b = 27$

-> **Output:** $\text{GCD} = 1$, $\text{LCM} = 1512$



The screenshot shows a window titled "Mars Messages" with a "Run I/O" button. The text area contains the following output:

```
Enter the first positive integer a = 56  
Enter the second positive integer b = 27  
  
The greatest common divisor GCD = 1  
  
The lowest common multiple LCM = 1512  
-- program is finished running --
```

A "Clear" button is visible on the left side of the text area.

Exercise 3:

+ **Test 1:** 1, 2, 3, 4, 5, 6, 7

-> **Output:**

Please insert a element: 1

Please insert a element: 2

Please insert a element: 3

Please insert a element: 4

Please insert a element: 5

Please insert a element: 6

Please insert a element: 7

The original array is: 1, 2, 3, 4, 5, 6, 7

Building max heap: 7, 5, 6, 4, 2, 1, 3

Building max heap: 6, 5, 3, 4, 2, 1, 7

Building max heap: 5, 4, 3, 1, 2, 6, 7

Building max heap: 4, 2, 3, 1, 5, 6, 7

Building max heap: 3, 2, 1, 4, 5, 6, 7

Building max heap: 2, 1, 3, 4, 5, 6, 7

Building max heap: 1, 2, 3, 4, 5, 6, 7

The sorted array is: 1, 2, 3, 4, 5, 6, 7

```
Mars Messages Run I/O
Please insert a element: 1
Please insert a element: 2
Please insert a element: 3
Please insert a element: 4
Please insert a element: 5
Please insert a element: 6
Please insert a element: 7
The original array is: 1, 2, 3, 4, 5, 6, 7
Building max heap: 7, 5, 6, 4, 2, 1, 3
Building max heap: 6, 5, 3, 4, 2, 1, 7
Building max heap: 5, 4, 3, 1, 2, 6, 7
```

```
Mars Messages Run I/O
Building max heap: 6, 5, 3, 4, 2, 1, 7
Building max heap: 5, 4, 3, 1, 2, 6, 7
Building max heap: 4, 2, 3, 1, 5, 6, 7
Building max heap: 3, 2, 1, 4, 5, 6, 7
Building max heap: 2, 1, 3, 4, 5, 6, 7
Building max heap: 1, 2, 3, 4, 5, 6, 7
The sorted array is: 1, 2, 3, 4, 5, 6, 7

-- program is finished running --
```

+ **Test 2:** 7, 6, 5, 4, 3, 2, 1

-> **Output:**

Please insert a element: 7

Please insert a element: 6

Please insert a element: 5

Please insert a element: 4

Please insert a element: 3

Please insert a element: 2

Please insert a element: 1

The original array is: 7, 6, 5, 4, 3, 2, 1

Building max heap: 7, 6, 5, 4, 3, 2, 1

Building max heap: 6, 4, 5, 1, 3, 2, 7

Building max heap: 5, 4, 2, 1, 3, 6, 7

Building max heap: 4, 3, 2, 1, 5, 6, 7

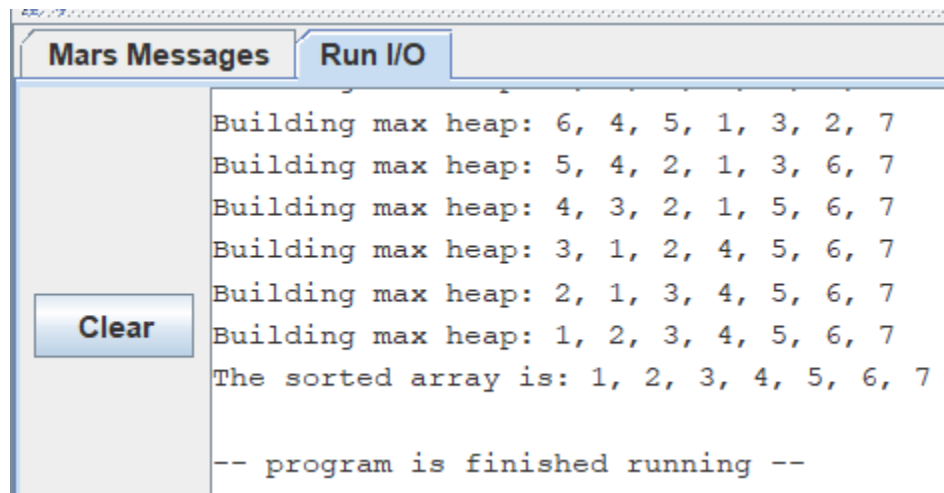
Building max heap: 3, 1, 2, 4, 5, 6, 7

Building max heap: 2, 1, 3, 4, 5, 6, 7

Building max heap: 1, 2, 3, 4, 5, 6, 7

The sorted array is: 1, 2, 3, 4, 5, 6, 7

Mars Messages	Run I/O
<div>Clear</div>	Please insert a element: 7
	Please insert a element: 6
	Please insert a element: 5
	Please insert a element: 4
	Please insert a element: 3
	Please insert a element: 2
	Please insert a element: 1
	The original array is: 7, 6, 5, 4, 3, 2, 1
	Building max heap: 7, 6, 5, 4, 3, 2, 1
	Building max heap: 6, 4, 5, 1, 3, 2, 7
Building max heap: 5, 4, 2, 1, 3, 6, 7	



```
Building max heap: 6, 4, 5, 1, 3, 2, 7
Building max heap: 5, 4, 2, 1, 3, 6, 7
Building max heap: 4, 3, 2, 1, 5, 6, 7
Building max heap: 3, 1, 2, 4, 5, 6, 7
Building max heap: 2, 1, 3, 4, 5, 6, 7
Building max heap: 1, 2, 3, 4, 5, 6, 7
The sorted array is: 1, 2, 3, 4, 5, 6, 7

-- program is finished running --
```

+Test 3: 0, 24, 13, 6, 8, 10, 9

-> Output:

Please insert a element: 0

Please insert a element: 24

Please insert a element: 13

Please insert a element: 6

Please insert a element: 8

Please insert a element: 10

Please insert a element: 9

The original array is: 0, 24, 13, 6, 8, 10, 9

Building max heap: 24, 8, 13, 6, 0, 10, 9

Building max heap: 13, 8, 10, 6, 0, 9, 24

Building max heap: 10, 8, 9, 6, 0, 13, 24

Building max heap: 9, 8, 0, 6, 10, 13, 24

Building max heap: 8, 6, 0, 9, 10, 13, 24

Building max heap: 6, 0, 8, 9, 10, 13, 24

Building max heap: 0, 6, 8, 9, 10, 13, 24

The sorted array is: 0, 6, 8, 9, 10, 13, 24

Mars Messages	Run I/O
<div>Clear</div>	Please insert a element: 0
	Please insert a element: 24
	Please insert a element: 13
	Please insert a element: 6
	Please insert a element: 8
	Please insert a element: 10
	Please insert a element: 9
	The original array is: 0, 24, 13, 6, 8, 10, 9
	Building max heap: 24, 8, 13, 6, 0, 10, 9
	Building max heap: 13, 8, 10, 6, 0, 9, 24
Building max heap: 10, 8, 9, 6, 0, 13, 24	

Mars Messages	Run I/O
<div>Clear</div>	Building max heap: 13, 8, 10, 6, 0, 9, 24
	Building max heap: 10, 8, 9, 6, 0, 13, 24
	Building max heap: 9, 8, 0, 6, 10, 13, 24
	Building max heap: 8, 6, 0, 9, 10, 13, 24
	Building max heap: 6, 0, 8, 9, 10, 13, 24
	Building max heap: 0, 6, 8, 9, 10, 13, 24
	The sorted array is: 0, 6, 8, 9, 10, 13, 24
	-- program is finished running --