**COMP1411 (Group 2011) Introduction to Computer Systems**

Take-home exam Time: 12:30 ~ 14:30, 30-April-2022 (Saturday)

**Answer Book**

|  |  |
| --- | --- |
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**Instructions:**

* Please fill in your name and student number in the above table.
* Please type your answers into this answer book, and then submit this answer book.
* You must answer questions by yourself only.
* You are not allowed to discuss questions and answers with other people.

**Question 1. [15 marks]**

movq %rdi, %rax

movq %rax, %rdx

movq $ 5 , %rcx /\* input an immediate number \*/

\_shrq %rcx, %rax /\* input an instruction \*/

subq $1, %rcx /\* input an instruction \*/

movq %rcx, %rdx /\* input an instruction \*/

subq %rdx, %rax

shrq $ 2 , %rcx /\* input an immediate number \*/

subq %rcx, %rdx /\* input an instruction \*/

subq %rdx, %rax

movq %rax, %rbx

**Question 2. [10 marks]**

**21093962D**

6 🡺 110 🡺 0110

2 🡺 10 🡺 0010

62 🡺 01100010

E =

**Question 3. [20 marks]**

**3(a)**

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Description automatically generated**

**3(b)**

**2 3 4 2 3 5 2 4 3 4 3 5**

**The first output are 2 and 3, the second are 4 and 5, the total is 4.**

**2 and 3 can be 3 and 2 (2)**

**4 and 5 not reverse (1)**

**2 and 3 must before 4 and 5 (2)**

**2 x 2 x 1= 4**

**Question 4. [12 marks]**

**21093962D**

**First: 0x2109**

**Second: 0x3962**

**2 KB = 2 ^ 11 B**

**First:**

**00100 00100001001 🡺 00100 is 4 base 10**

**X = 4**

**Y = X + 5 = 4 + 5 = 9**

**0100100100001001 🡺 0x4909**

**The first PP is 0x4909**

**Second:**

**00111 00101100010 🡺 00111 is 7 base 10**

**X = 7**

**Y = X + 5 = 7 + 5 = 12**

**110000101100010 🡺 0x6162**

**The second PP is 0x6162**

**Question 5. [10 marks]**

**5(a)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A | B | C | D | E | F | G | H |
| 2ms | 1ms | 0ms | 9ms | 3ms | 9ms | 6ms | 2ms |

ABCD | EF | GH 🡺 12 | 12 | 8

**5(b)**

Throughput = 1 / ((12 + 2) \* 10 ^ (-3)) = 71 IPS

Latency = (12 + 2) \* 3 = 42 ms

**Question 6. [20 marks]**

**6(a)**

**50 30 02 00 00 00 00 00 00 00 🡺 mrmovq 0x02(%rax) %rbx**

**30 F1 1E 00 00 00 00 00 00 00 🡺 irmovq $30 %rcx**

**50 42 13 00 00 00 00 00 00 00 🡺 mrmovq 0x13(%rdx) %rsp**

**60 67 🡺 addq %rsi %rdi**

**6(b) Please fill in the table.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Instruction** | **Start**  **Time** | **End**  **Time** | **F** | **D** | **E** | **M** | **W** | **P** |
| **mrmovq 0x02(%rax) %rbx** | **1** | **15** | **3** | **2** | **2** | **4** | **2** | **2** |
| **irmovq $30 %rcx** | **16** | **26** | **3** | **1** | **2** | **1** | **2** | **2** |
| **mrmovq 0x13(%rdx) %rsp** | **27** | **41** | **3** | **2** | **2** | **4** | **2** | **2** |
| **addq %rsi %rdi** | **42** | **53** | **3** | **2** | **2** | **1** | **2** | **2** |

**Question 7. [13 marks]**

**7(a)**

A B H B H B H C E H D

So, the total of 11 variable accesses.

**7(b)**

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