Introduction to Computing Systems
Homework 6

PB18111697 王章瀚

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1.

•The trap vector has 8 bits, which means up to 256 serveice routines can be specified.

•We won't be sure about which address shall be filled into PC when returning, while the BRnzp can only set PC to a certain value. Instead, using the RET, PC will be set as the R7's value, which is variable.

•1. The first is to access the vector table to get the service routine's address and load it into PC.

2.

The last thing you stored in it is the first thing you remove from it.

One example is the behaviour of a coin holder. Another is in hardware-data entries move.

The difference lies in whether remove the value after pop. In the first one, the value, which is the coins, will be removed, while in the second one, the value stays but the cursor moves.

3.

a.

push	Z
push	Y
pop	Y
push	X
pop	X
push	W
push	V
pop	V
push	U
pop	U
pop	W
pop	Z
push	T
push	S
pop	S
push	R
pop	R
pop	T

b.

$\binom{4}{8} - \binom{4+1}{8} = 14$

4.

```
1     ; Using R0 and R1 to push or pop.
2     PUSH            ST      R2, Save2
3                     LD      R2, MAX
4                     ADD     R2, R6, R2
5                     BRz     fail_exit
6                     ADD     R6, R6, #-2
7                     STR     R0, R6, #0
8                     STR     R1, R6, #1
9                     BRnzp   success_exit
10
11
12    POP             ST      R2, Save2
13                    LD      R2, BASE
14                    ADD     R2, R6, R2
15                    BRz     fail_exit
16                    ADD     R6, R6, #2
17                    LDR     R0, R6, #-2
18                    LDR     R1, R6, #-1
19    success_exit    LD      R2, Save2
20                    AND     R5, R5, #0
21                    RET
22
23    fail_exit       LD      R2, Save2
24                    AND     R5, R5, #0
25                    ADD     R5, R5, #1
```

```
26
27      BASE            .FILL   x-4006
28      MAX             .FILL   x-4001
29      Save2           .FILL   x0000
30
```

5.

Ouput "EE some"

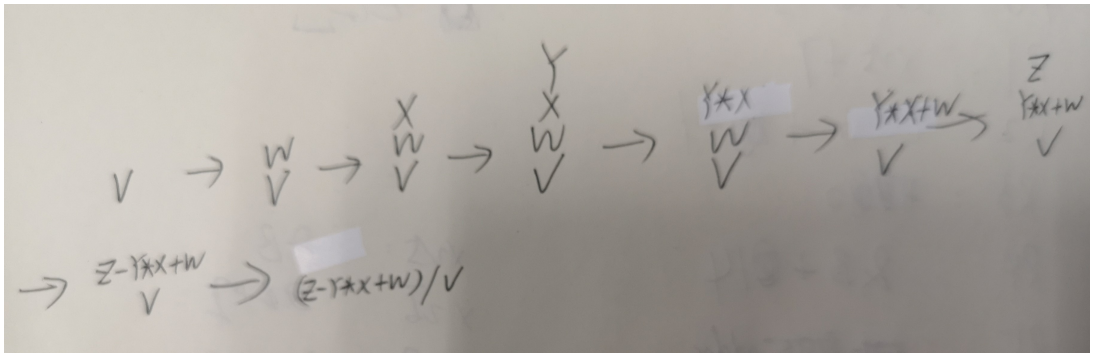
6.

ADD at A will be executed for length(string) times.

ST R7, Save7 and LD R7, Save7 should be added. Because a TRAP is used in the routine, and R7 will be changed that this PUTS cannot return to the upper program.

7.

a



b

```
1       PUSH    C
2       PUSH    A
3       ADD
4       PUSH    D
5       PUSH    C
6       PUSH    B
7       SUB
8       ADD
9       PUSH    A
10      MUL
11      DIV
12
```