Fundamental of Computer Science

Homework Set 6

November 29, 2023

1. (2') Determine whether the following description is correct and fill 'True' or 'False' in the forms ("T/F", "Yes/No", "0/1" will be regarded as wrong answers).

(a) Generally speaking, human-readable program composed of letters and symbols (e.g., C, Python) needs to be converted into binary machine code before it can be executed by a computer.

(b) Any program with *goto* statements can be equivalently converted to a program without *goto*.

(c) We should use *goto* statements as much as possible in modern software development due to its flexibility.

(d) Considering the general programming language, the following addition statement "Alice=Bob+Cindy" will be interpreted as 15 tokens by the compiler (a token is a string with an assigned and thus identified meaning).

(a)	True
(b)	True
(c)	False
(d)	False

2. (8') The following V8 program is equivalent to the pseudocode below. V8 program running from address 00. Hint: this program uses the address segment starting at 0xFF to swap in and swap out the register value of 'fib' when recursion occurs (this mechanism is also called the 'call stack'). Hint: You can first refer to Appendix C to translate the following machine code into easy-to-understand pseudocode.

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Contents	2E	FF	22	06	2F	08	B0	10	C0	00	00	00	00	00	00	00
Address	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
Contents	B2	4C	23	FF	52	23	B2	48	3E	1B	3F	00	5E	E3	2F	22
Address	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
Contents	B0	10	3E	25	31	00	23	FF	5E	E3	52	23	2F	30	B0	10
Address	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
Contents	23	01	5E	E3	3E	37	14	00	51	14	5E	E3	3E	3F	1F	00
Address	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
Contents	52	23	52	23	3F	47	B0	00	23	01	52	23	21	01	3F	51
Address	50	51														
Contents	B0	00														

```
fib(n):
    if n==0 or n==1
        return 1
    else
        return fib(n-1) + fib(n-2)

main:
    a = fib(6)
```

(a) Codes from 0x10 to 0x51 constitute the procedural unit 'fib'. Is it a function or a procedure? Fill an uppercase letter in the form.

A. Function B. Procedure

(b) Which register is used for passing the parameter (i.e., variable 'n') to the procedural unit from 0x10 to 0x51? Fill the register in the form (e.g., "R0", "R1", …, "RF" without quotes).

(c) Which register is used to store the return value (i.e., the value returned by the return statement) of the procedural unit from 0x10 to 0x51? Fill the register in the form (e.g., "R0", "R1", …, "RF" without quotes).

(d) Which register is used to store the return address of the procedural unit from 0x10 to 0x51 (i.e., the address to jump to after return statement executed)? Fill the register in the form (e.g., "R0", "R1", …, "RF" without quotes).

(e) Is this code iterative or recursive? Fill an uppercase letter in the form.

A. Iterative B. Recursive

(f) How many times has the code at address 0x10 been executed? Fill a decimal integer in the form.

(g) What is the value of register 1 (R1) after the program halts? Fill a 2-character hexadecimal number (digits and uppercase letters) in the forms.

(h) What is the value of register E (RE) after the program halts? Fill a 2-character hexadecimal number (digits and uppercase letters) in the forms.

(a)	A	(b)	R2	(c)	R1	(d)	RF
(e)	B	(f)	21	(g)	0D	(h)	FF