

MODULE CODE	EXAMINER	DEPARTMENT	TEL
CPT101	STEVEN GUAN	COMPUTING	1501

1st SEMESTER 2021/22 Open-Book FINAL EXAMINATIONS

BACHELOR DEGREE – Year 2

COMPUTER SYSTEMS

TIME ALLOWED: 2 Hours

INSTRUCTIONS TO CANDIDATES

- 1、 This is an open-book exam. Please tick the integrity disclaimer *immediately after you initiate the online open-book exam* and complete the assessment independently and honestly.
- 2、 Total marks available are 100.
- 3、 Answer all questions. There is NO penalty for providing a wrong answer.
- 4、 Only answers in English are accepted.
- 5、 The duration is 2 hours. Where there are any major problems preventing you from continuing the exam or submitting your answers in time, please do not hesitate to email the Module Examiner (steven.guan@xjtlu.edu.cn) or Assessment Team of Registry (assessment@xjtlu.edu.cn).

Answer All Questions

Part I. Each of the following questions comprises 5 statements, for which you should select the most appropriate one. Attempt all questions. The exam mark is based on the overall number of correctly answered questions; incorrectly answered questions do not count against you. Each question is worth 2.5 marks.

1. (b) The closed, concentric rings on a hard disk are referred to as
☐ a) grooves ☐ b) tracks ☐ c) sectors ☐ d) circles ☐ e) allocation tables

2. (a) What type of flip-flop allows us to copy data?
☐ a) D flip-flop ☐ b) toggle flip-flop ☐ c) SR flip-flop
☐ d) J flip-flop ☐ e) ST flip-flop

3. (e) What is the hexadecimal equivalent of 10101111? ^{十六进制}
☐ a) 9B ☐ b) DE ☐ c) AE ☐ d) 6E ☐ e) AF
 $1+2+4+8 = 15 = F$
 $10 = 2+8$

4. (c) Executing more than one program concurrently by one (or more than one) user on one computer is known as
☐ a) multicasting ☐ b) nesting ☐ c) multitasking
☐ d) client-server computing ☐ e) interrupt processing

5. (d) Working with 7 bits, what is the two's complement representation of -17?
☐ a) 1101001 ☐ b) 1111011 ☐ c) 0001011 ☐ d) 1101111 ☐ e) 1100101

6. (e) Which of the following is needed to generate executable code by combining object codes and library files together?
☐ a) compiler ☐ b) interpreter ☐ c) assembler ☐ d) loader ☐ e) linker

7. (d) Comparing against CISC, which of the following is an advantage of adopting RISC philosophy in designing computers?

- ☐ a) Instruction execution is slower \times
- ☐ b) instruction set is more friendly in supporting HLL constructs \times
- ☐ c) Instruction set implementation is more expensive \times
- ☐ d) Instruction set implementation requires less chip area \checkmark
- ☐ e) None of the above

8. (C) Which flag will be set after the execution of the instruction "CMP ESI, EDI" if the contents of ESI and EDI are equal?

- ☐ a) D flag ☐ b) T flag ☐ c) Z flag ☐ d) S flag ☐ e) O flag

9. (b) Using two bytes only, what is the encoding of number 239 in BCD format?

- ☐ a) 1000000100111011 ☐ b) 0000001000111001 ☐ c) 0000000110111001
- ☐ d) 0010000001111001 ☐ e) 0010001001111001

BCD每四位表示一个十进制数字

10. (d) What registers are used to delimit a stack frame on the program stack during subroutine calls?

- ☐ a) EAX,EBX ☐ b) ECX,EDX ☐ c) ESI,EDI ☐ d) EBP,ESP ☐ e) EAX,EDX

EBP: 基址指针寄存器

ESP: 堆栈指针寄存器

11. (C) Assume a block of 256 data bytes has to be stored. Which of the following solutions is NOT sufficient?

- ☐ a) 8bit system with memory locations 0000 to 00FF \checkmark $16 \times 15 + 15 = 255 + 1 = 256$
- ☐ b) 24bit system with memory locations 0000 to 0055 $(16 \times 15 + 15 + 1) \times 3 = 258$
- ☐ c) 16bit system with memory locations 0000 to 007E $(16 \times 7 + 14 + 1) \times 2 = 254$
- ☐ d) 32bit system with memory locations 0000 to 005E $(16 \times 5 + 14 + 1) \times 4 = 380$
- ☐ e) 64bit system with memory locations 0000 to 0022 $(16 \times 2 + 14) \times 8 = 280$

12. (C) Under 4-digit 10's complementary coding, 4157 represents 10000 5000
-5000 ~ 4999
☐ a) 157 ☐ b) -157 ☐ c) 4157 ☐ d) -4157 ☐ e) none of the above

13. (C) Assume there are 5 devices to be interconnected with 8 data lines (wires) plus 4 control lines (wires), how many wires are needed if point-to-point connection scheme is used? 12 x 10 = 120
☐ a) 32 ☐ b) 64 ☐ c) 120 ☐ d) 180 ☐ e) None of the above

14. (a) Name 2 registers that are always used during each instruction execution.
☐ a) IP, IR ☐ b) ECX, EDX ☐ c) EAX, EFLAG ☐ d) EBX, EBP
☐ e) None of the above

15. (e) Which register is affected by the execution of "CMP EAX, EBX" instruction?
IP: 指令指针 IR: 指令寄存器
☐ a) EAX ☐ b) EBX ☒ c) ECX ☐ d) ESI ☐ e) None of the above

16. (d) Which of the following is associated with labels during the assembly process?
影响 Flag Register
☐ a) constants ☐ b) data ☐ c) interrupts ☐ d) memory addresses ☐ e) stack

17. (e) Which of the following flags can affect the branching effect of "LOOPNE label" instruction?
☐ a) A flag ☐ b) D flag ☐ c) O flag ☐ d) P flag ☐ e) Z flag

18. (b) Which of the following is used by Java interpreter as input?
☐ a) micro codes ☐ b) byte codes ☐ c) source codes ☐ d) bit codes
☐ e) macro codes

19. (C) Assume 16-bit sample size is used for audio with these specifications - stereo, sampling rate at 44.1KHz. How many Mbytes of data a CDrom can store by maximum if it can store up to 60 minutes of stereo audio without data compression?
☐ a) 127 ☐ b) 256 ☐ c) 605 ☐ d) 864 ☐ e) None of the above

$$44.1 \times 1000 \times 2 \times 16 \times 60 \times 60$$
$$1024 \cdot 1024 \cdot 8$$

20. (a) Disk cache is typically part of?

- ☐ a) hard disk ☐ b) MMU ☐ c) cache control unit ☐ d) memory
☐ e) None of the above

21. (e) Assume Process A needs 5 pages of memory. When the CPU runs the process, it requests data from each of the 5 pages with equal probability. Assume that the average time to read a word of data from main memory is 5 ns. Assume the average time to read/write a page from hard disk from/into main memory is 5000ns. Furthermore, assume that a page must be swapped out to make room for the incoming page. Assume no caching is used. What is the average access time to read a word of data if 1 page of process A is stored in main memory at one time while the content of the other 4 pages are on hard disk?

- ☐ a) 5 ns ☐ b) 5005 ns ☐ c) 7505 ns ☐ d) 8005 ns ☐ e) 10005 ns

$$\frac{1}{5} \times 5 + \frac{4}{5} (5000 \times 2 + 5) = 8005$$

22. (b) What is the range of integers encoded with 7 bits using sign-and-magnitude representation?

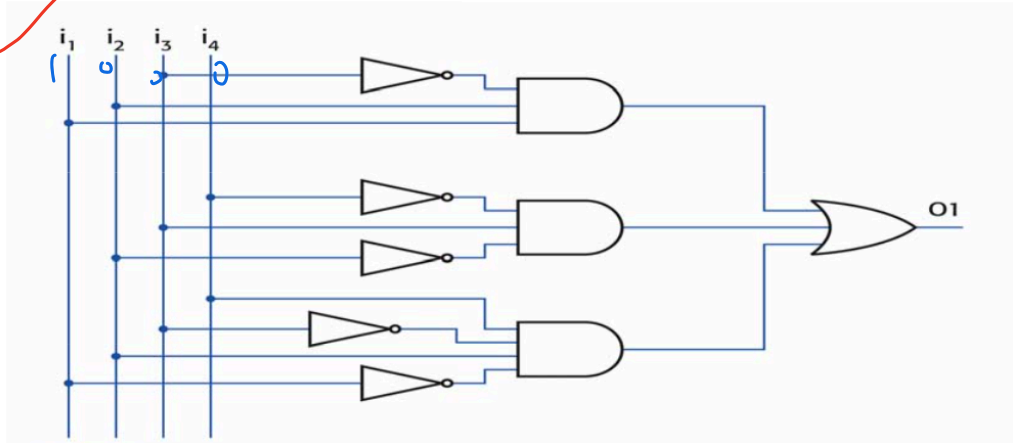
- ☐ a) [-31, 31] ☐ b) [-63, 63] ☐ c) [-255, 255] ☐ d) [-127, 127]
☐ e) [-1023, 1023]

23. (d) In one's complement system, what is the integer that the binary value 10011111 represents?

- ☐ a) 63 ☐ b) 85 ☐ c) -79 ☐ d) -96 ☐ e) -15

$$128 + 30 + 1 = 159$$

24. (a) Which of the following value for input (i_1, i_2, i_3, i_4) gives the output O1 value as 1 in the following Boolean circuit?



- ☐ a) (1,1,0,0) ✓
☐ b) (1,0,0,1)
☐ c) (1,1,1,1)
☐ d) (1,0,0,0)
☐ e) (0,0,0,1)

25. (b) If four integer parameters were pushed onto stack when calling 'scanf' in inline assembly, how would you adjust the value of register 'esp' when returning from 'scanf'?

- ☐ a) add ESP, 8 ☐ b) add ESP, 16 ☐ c) sub ESP, 8
☐ d) sub ESP, 16 ☐ e) No action required

26. (c) Consider the following variation of complement-based coding scheme. Assume the following weighting scheme is used for encoding (or decoding) of 8-bit binary numbers:

128 -64 32 -16 8 4 2 -1

Which of the following integer is not representable by such a coding scheme?

- ☐ a) -101 ☒ b) -1 ☒ c) 66 ☒ d) 0 ☒ e) 137

9. 27. (b) When a subroutine is about to finish its job and before it returns to the caller, which of the following does not occur?
- ☐ a) all local variables are popped out of the stack ✓
 - ☐ b) the previous EBP address is popped from the top of the stack and restored in EBP
 - ☐ c) parameters are cleaned up in the stack ✓
 - ☐ d) the return address is popped off the stack
 - ☐ e) none of the above

9. 28. (c) When passing parameters from our inline assembly code to a C I/O library function such as 'scanf', the number of parameters is passed ...
- ☐ a) by value
 - ☐ b) by reference
 - ☐ c) by register
 - ☐ d) by cache
 - ☐ e) none of the above

29. (b) The following binary number in 32 bits represents a floating point number based upon the IEEE 754 standard in single precision.

01000001000010000000000000000000

What is the floating point number being encoded?

- ☐ a) -1205
- ☐ b) 8.5
- ☐ c) -785.25
- ☐ d) 61256
- ☐ e) 8008

30. (e) Given the following C library function 'scanf' statement to be simulated via inline assembly code,

how many parameters need to be pushed to the program stack before "call scanf"?

scanf("%d %d %c", a, b, c);

Here we assume a, b are integers while c is a character.

- ☐ a) 0
- ☐ b) 1
- ☐ c) 2
- ☐ d) 3
- ☐ e) 4

Part II. Answer all of the following.

31. Drag-and-drop (for online test) or write the sequence number (for on-site test) of the assembly code to form a program where 7 numbers in an array are added and stored in the ebx register. Note that your sequence must absolutely match the line numbers to the left-most column of the table otherwise 3 marks will be deducted for each incorrect match. The answer for the first line has been provided. Complete the rest. (15 marks)

	Correct Sequence	Pick From Here
Line 1	4	1 myLoop: add ebx, [eax]
Line 2	5	2 loop myLoop
Line 3	6	3 jmp myLoop
Line 4	1	4 mov ebx, 0
Line 5	8	5 mov ecx, 7
Line 6	2	6 mov eax, array
		7 myLoop: add ebx, eax
		8 add eax, 4
		9 mov ecx, 6

32. Fill in the missing places with the correct arguments/instructions for a program that sort integers in ascending order. (10 marks)

```

lea    esi, intArray
L1:
    mov    eax, [esi]
    cmp    [esi+4], eax
    chg mov    L2
    mov    eax, [esi+4]
    mov    [esi], eax
L2:
    add    esi, 4
    jmp    L1

```

END OF PAPER