✓   Quiz submitted   ✕   ✎ **Edit**   ⋮

Practice: Fall 2023

ⓘ This is a preview of the draft version of the quiz

Instructions

- **THIS IS A CLOSED BOOK, CLOSED NOTES EXAM**
-
- This exam is an individual effort.
- You are not permitted to help others, in any way, with this exam.
- You are not permitted to release or to discuss this exam with anyone, except the course staff, until given permission to do so by the instructors (which will not occur until all students have completed the exam. There may be exceptional cases that take it late).
- A simple calculator is permitted, but won't prove to be helpful (we don't think).
- You have 180 minutes, from first exposure through submission to take this exam. Do not attempt to "peek", "check", or "test" the exam. This will start your clock.
- We only expect the exam to take 70-90 minutes.
- The exam counts for the 25% "exam portion" of the midterm grade, but is reduced to counting as a "double homework" for the final grade.
- In order to make the exam an "invested but low stakes" experience, half of this exam's weight toward the final grade may be dropped as one of the two "homework drops", but the full weight can't be dropped.

Quiz Type	Graded Quiz
Points	100
Assignment Group	Midterm Exam (Homeworks #6 and #7)
Shuffle Answers	No
Time Limit	180 Minutes
Multiple Attempts	No

	Always
View Resp	✓ Quiz submitted
Show Correct Answers	After Oct 16, 2023 at 11:59pm
One Question at a Time	No
Require Respondus LockDown Browser	No
Required to View Quiz Results	No
Webcam Required	No

Due	For	Available from	Until
May 9	Everyone	Jan 16 at 12:01am	May 9 at 11:59pm

Preview

Score for this quiz: 0 out of 100

Submitted Aug 24 at 9:15am

This attempt took less than 1 minute.

⠿

UnansweredQuestion 1

0 / 15 pts

Integers (5 points, 1 point per blank)

Fill in the five empty boxes in the table below when possible and indicate "UNABLE" when impossible.

	6-bit 2s complement signed	**6-bit unsigned**
Binary representation of -28 decimal		------------------------

Binary re... decimal	✓ Quiz submitted	
Binary representation of Tmin (negative)		-----------------------
Integer (Decimal) value of (16 + 18)		-----------------------

Answer 1:

You Answered (You left this blank)

Correct Answer

100100

Correct Answer

10 0100

Answer 2:

You Answered (You left this blank)

Correct Answer

unable

Correct Answer

Unable

Correct Answer

UNABLE

Correct Answer

"unable"

Correct Answer

"Unable"

Correct Answer

"UNABLE"

Answer 3:

You Answered (You left this blank)

Correct Answer

100100

Correct Answer

10 0100

Correct Answer

100 100

Correct Answer

100100b

> ✓   **Quiz submitted**

Correct Answer

0x24

Correct Answer

24

Answer 4:

You Answered (You left this blank)

Correct Answer

100000

Correct Answer

100 000

Correct Answer

10 0000

Correct Answer

0x20

Correct Answer

20

Correct Answer

100000b

Answer 5:

You Answered (You left this blank)

Correct Answer

100010

Correct Answer

100 010

Correct Answer

10 0010

Correct Answer

0x22

Correct Answer

10010b

Correct Answer

22

⋮⋮

UnansweredQuestion 2

0 / 1 pts

Question 2: Flo   ✓   Quiz submitted

This question is based upon an IEEE-like floating point format with the following specification:

- 8-bit width
- There is s = 1 sign bit
- There are k = 3 exponent bits
- Wherever rounding is necessary, round-to-even should be In addition, you should give the rounded value of the encoded floating point number.

2(A) (1 points) What is the bias?

You Answered

[ ]

3 (with margin: 0)

⋮⋮

UnansweredQuestion 3

0 / 1 pts

Question 2: Floats

This question is based upon an IEEE-like floating point format with the following specification:

- 8-bit width
- There is s = 1 sign bit
- There are k = 3 exponent bits
- Wherever rounding is necessary, round-to-even should be In addition, you should give the rounded value of the encoded floating point number.

2(B) (1 points) What is the exponent for denormalized numbers?

You Answered

[ ]

-2 (with margin: 0)

⋮⋮

UnansweredQuestion 4

0 / 1 pts

Question 2: Floats

This question is based upon an IEEE-like floating point format with the following specification:

✓   Quiz submitted

- 8-bit width
- There is s = 1 sign bit
- There are k = 3 exponent bits
- Wherever rounding is necessary, round-to-even should be In addition, you should give the rounded value of the encoded floating point number.

2(C) (1 points) What is the minimum exponent for normalized numbers (*Hint: Most negative)*?

You Answered

-2 (with margin: 0)

⠿

UnansweredQuestion 5

0 / 1 pts

Question 2: Floats

This question is based upon an IEEE-like floating point format with the following specification:

- 8-bit width
- There is s = 1 sign bit
- There are k = 3 exponent bits
- Wherever rounding is necessary, round-to-even should be In addition, you should give the rounded value of the encoded floating point number.

2(D) (1 points) What is the maximum exponent for normalized numbers (*Hint: Most positive)*?

You Answered

3 (with margin: 0)

⠿

UnansweredQuestion 6

0 / 6 pts

Question 2: Floats

2(E-H) (6 points) Fill in the following:

Value	Binary Representation	reduced decimal fraction
-5/32		--
-13/32		--
19/128		+ [ ] / [ ]

Answer 1:

You Answered (You left this blank)

Correct Answer

1 000 1010

Correct Answer

10001010

Answer 2:

You Answered (You left this blank)

Correct Answer

1 001 1010

Correct Answer

10011010

Answer 3:

You Answered (You left this blank)

Correct Answer

0 000 1010

Correct Answer

00001010

Answer 4:

You Answered (You left this blank)

Correct Answer

5

Correct Answer

+5

Correct Answer

+ 5

Answer 5:

You Answered (You left this blank)

Correct Answer

32

Correct Answer

+32

Correct Answer

+ 32

⁞

3. (20 points) **Assembly**

Please consider the following assembly code segment:

```
        movl    %edi, -4(%rbp)
        movl    %esi, -8(%rbp)
        movl    %edx, -12(%rbp)
        movl    %ecx, -16(%rbp)
        movl    -4(%rbp), %eax
        cmpl    -8(%rbp), %eax
        jle     .L2
        jmp     .L3
 .L4:
        movl    -8(%rbp), %eax
        movl    %eax, %esi
        movl    $.LC0, %edi
        movl    $0, %eax
        call    printf
        addl    $1, -8(%rbp)
 .L3:
        movl    -8(%rbp), %eax
        cmpl    -4(%rbp), %eax
        jle     .L4
 .L2:
        movl    -8(%rbp), %eax
        cmpl    -4(%rbp), %eax
        jle     .L1
        jmp     .L6
 .L7:
        movl    -4(%rbp), %eax
        movl    %eax, %esi
        movl    $.LC0, %edi
        movl    $0, %eax
        call    printf
```

```
        addl    $1, -4(%rbp)
.L6:
        movl                    Quiz submitted
        cmpl    -8(%rbp), %eax
        jle     .L7
.L1:
```

UnansweredQuestion 7

0 / 4 pts

3(A) (4 points): How many loops are within this question?

You Answered

2 (with margin: 0)

UnansweredQuestion 8

0 / 4 pts

3(B) (4 points): How many if statements are within this question (that can't be considered part of the pre-test for an if or while loop)?

You Answered

2 (with margin: 0)

UnansweredQuestion 9

0 / 4 pts

3(C) (4 points): Do two or more loops share the same loop control variable (a variable which is updated by the body of the loop and used as part of the test for the loop)?

○ Yes

Correct Answer

○ No

UnansweredQuestion 10

0 / 4 pts

3(D) (4 points): Do two or more loops share the same end point? In other words, do they stop when the loop control variable reaches the same value or condition?

○ Yes

Correct Answer

○ No

⋮⋮

UnansweredQue ✓ **Quiz submitted**

0 / 4 pts

3(E) (4 points): Are the loop(s) most likely pre-test loops, e.g. while or for, or post-test loops, e.g. do-while?

Correct Answer

○ Pre-test

○ Post-test

⋮⋮

4. (20 points) **Structs and Alignment**

Consider the following struct:

```
struct {
  short s; // 2-byte type
  int i;   // 4-byte type
  short sa[4];
  char c; // 1-byte type
} exam;
```

Assume a system which requires "natural alignment", i.e. each type needs to be aligned to a multiple of its size (width).

⋮⋮

UnansweredQuestion 12

0 / 3 pts

4(A) (3 points): How many bytes of padding would the compiler place immediately before s?

You Answered

0 (with margin: 0)

⋮⋮

UnansweredQuestion 13

0 / 4 pts

4(B) (4 points): How many bytes of padding would the compiler place immediately before i?

You Answered

2 (with margin: 0)

⋮⋮

UnansweredQuestion 14

0 / 4 pts

4(C) (4 points): How many bytes of padding would the compiler place immediately before sa?

You Answered

0 (with margin: 0)

⋮⋮⋮

UnansweredQuestion 15

0 / 3 pts

4(D) (3 points): (3 points) How many bytes of padding would the compiler place immediately before c?

You Answered

0 (with margin: 0)

⋮⋮⋮

UnansweredQuestion 16

0 / 3 pts

4(E) (3 points): How many bytes of padding would the compiler place immediately after c?

You Answered

3 (with margin: 0)

⋮⋮⋮

UnansweredQuestion 17

0 / 3 pts

4(F) (3 points): At most, how many bytes could be saved by reordering the fields of the struct?

You Answered

4 (with margin: 0)

⋮⋮⋮

UnansweredQuestion 18

0 / 3 pts

Arrays Sizes (4 points)

Consider the following definitions in an x86-64 system with 8-byte pointers and 4-byte ints. Answer with only a decimal number

Definition A	✓ Quiz submitted
int numbersA[2][4][6];	int *numbersB = numbersA;

5(a)(1.5 point): How many bytes are allocated to numbersA? (Write "UNKNOWN" if not knowable):

[   ] Bytes

Hint: Think sizeof()

5(b) (1.5 point): How many bytes are allocated to numbersB? (Write "UNKNOWN" if not knowable):

[   ] Bytes

Hint: Think sizeof()

Answer 1:

You Answered (You left this blank)

Correct Answer

192

Correct Answer

192B

Correct Answer

192 B

Correct Answer

192Bytes

Correct Answer

192 Bytes

Correct Answer

192bytes

Correct Answer

192 bytes

Answer 2:

You Answered (You left this blank)

Correct Answer

8

Correct Answer

8B

Correct Answer

✓ Quiz submitted

8 Bytes

Correct Answer

8 bytes

Correct Answer

8Bytes

Correct Answer

8bytes

⋮

UnansweredQuestion 19

0 / 2 pts

Array Arithmetic

5(c) (2 points): Consider the following definitions as implemented on a shark machine, i.e. x86-64. What is the difference, i.e. number of bytes, between numbers[0][2] and numbers[2][2]? [distance] bytes

Definition A
int numbers[3][5];

You Answered

40 (with margin: 0)

⋮

UnansweredQuestion 20

0 / 1 pts

Part 6(A): Caching

Given a model described as follows:

- Number of sets: 8
- Total size: 64 bytes (not counting meta data)
- Block offset bits: 2

- Replacement policy: Set-wise LRU
- 8-bit address

✓   Quiz submitted

6(A)(1) (1 point) How many bits for the tag?

You Answered

0 (with margin: 0)
0 (with margin: 0)
3 (with margin: 0)

⋮⋮

UnansweredQuestion 21

0 / 1 pts

Part 6(A): Caching

Given a model described as follows:

- Number of sets: 8
- Total size: 64 bytes (not counting meta data)
- Block offset bits: 2
- Replacement policy: Set-wise LRU
- 8-bit addresses

6(A)(2) (1 point) How many lines per set?

You Answered

2 (with margin: 0)

⋮⋮

UnansweredQuestion 22

0 / 1 pts

Part 6(A): Caching

Given a model described as follows:

- Number of sets: 8
- Total size: 64 bytes (not counting meta data)
- Block offset bits: 2
- Replacement policy: Set-wise LRU
- 8-bit addresses

6(A)(3) (1 point) How many bytes per block?

| ✓ | Quiz submitted |

You Answered

4 (with margin: 0)

⋮⋮

UnansweredQuestion 23

0 / 12 pts

6(A)(4-9) Caching (12 points, 1 point each): Consider the following memory access trace, which is in order and begins at the beginning of time. For each of the following memory accesses, please indicate if it hits or misses, and if it misses, if it suffers from a capacity miss, a conflict miss, or a cold miss:

Question Number	Address	Hit or Miss? Circle one (per row):	Miss Type? Circle one (per row)
	0xA2		
6(A)(4)	0xD0	[Select]	[Select]
6(A)(5)	0XD7	[Select]	[Select]
6(A)(6)	0X92	[Select]	[Select]
6(A)(7)	0XD3	[Select]	[Select]
	0XB2		
6(A)(8)	0XA1	[Select]	[Select]
6(A)(9)	0X92	[Select]	[Select]

Answer 1:

You Answered (You left this blank)

Hit

Correct Answer

Miss

Unknowable

✓   Quiz submitted

Answer 2:

You Answered (You left this blank)

Correct Answer

Cold

Conflict

Capacity

N/A

Answer 3:

You Answered (You left this blank)

Hit

Correct Answer

Miss

Unknowable

Answer 4:

You Answered (You left this blank)

Correct Answer

Cold

Conflict

Capacity

N/A

Answer 5:

You Answered (You left this blank)

Hit

Correct Answer

Miss

Unknowable

Answer 6:

You Answered (You left this blank)

Correct Answer

Cold

Conflict

Capacity

N/A

Answer 7:

You Answered (You left this blank)

Correct Answer

Hit

Miss

Unknowable

Answer 8:

You Answered (You left this blank)

Cold

Conflict

Capacity

Correct Answer

N/A

Answer 9:

You Answered (You left this blank)

Correct Answer

Hit

Miss

Unknowbale

Answer 10:

You Answered (You left this blank)

Cold

Conflict

Capacity

Correct Answer

N/A

Answer 11:

You Answered (You left this blank)

Hit

Correct Answer

Miss

Unknowable

Answer 12:

You Answered (You left this blank)

Cold

Correct Answer

Conflict

Capacity

N/A

⠿

UnansweredQue ✓   Quiz submitted

0 / 3 pts

6(B) (3 points): Locality

Consider a cache with 8 sets, 2 lines/set, and a block size of 16 bytes on a system with 4-byte ints.

What is the maximum stride (index step) size while sequentially accessing a 1D int array to maintain a cache miss rate of no more than 42%?

You Answered

[   ]

1 (with margin: 0)

⠿

UnansweredQuestion 25

0 / 2 pts

6(C) (2 points): Memory Hierarchy and Effective Access Time

Imagine a system with a main memory layered beneath a cache:

- The cache has a 4ns access time.
- The main memory has an access time of 9ns.
- The cache miss rate is 20%.
- In the event of a miss, memory access time and cache access time **overlap**.

5(C) (2 points) What is the effective, overall access time in ns?

You Answered

[   ]

5 (with margin: 0)
5.8 (with margin: 0)

⠿

Switch Statement (10 points)

Please consider the following assembly, compiled on a shark machine:

```
(gdb) disassemble foo
Dump of assembler code for function foo:
   0x0000000000401136 <+0>:      endbr64
```

```
   0x000000000040113a <+4>:        push    %rbp
```

✓   Quiz submitted

```
   0x00000000004
   0x000000000040113e <+8>:        mov     %edi,-0x4(%rbp)              # %edi is 0th argument
   0x0000000000401141 <+11>:       mov     %esi,-0x8(%rbp)             # %esi is 1at argument
   0x0000000000401144 <+14>:       cmpl    $0x6,-0x8(%rbp)
   0x0000000000401148 <+18>:       ja      0x40117a <foo+68>
   0x000000000040114a <+20>:       mov     -0x8(%rbp),%eax
   0x000000000040114d <+23>:       mov     0x402008(,%rax,8),%rax
   0x0000000000401155 <+31>:       notrack jmp *%rax                   # You can ignore the notrack
and focus on the jmp
   0x0000000000401158 <+34>:       addl    $0x1,-0x4(%rbp)
   0x000000000040115c <+38>:       jmp     0x40117e <foo+72>
   0x000000000040115e <+40>:       shll    $0x2,-0x4(%rbp)
   0x0000000000401162 <+44>:       shll    -0x4(%rbp)
   0x0000000000401165 <+47>:       jmp     0x40117e <foo+72>
   0x0000000000401167 <+49>:       mov     -0x4(%rbp),%eax
   0x000000000040116a <+52>:       lea     0x3(%rax),%edx
   0x000000000040116d <+55>:       test    %eax,%eax
   0x000000000040116f <+57>:       cmovs   %edx,%eax
   0x0000000000401172 <+60>:       sar     $0x2,%eax
   0x0000000000401175 <+63>:       mov     %eax,-0x4(%rbp)
   0x0000000000401178 <+66>:       jmp     0x40117e <foo+72>
   0x000000000040117a <+68>:       addl    $0x2,-0x4(%rbp)
   0x000000000040117e <+72>:       mov     -0x4(%rbp),%eax
   0x0000000000401181 <+75>:       pop     %rbp
   0x0000000000401182 <+76>:       ret
End of assembler dump.
```

And the following memory dump:

```
(gdb) x/14xg 0x402000
0x402000            0x0000000000020001        0x000000000040117a
0x402010:           0x000000000040115e        0x0000000000401158
0x402020:           0x0000000000401162        0x000000000040117a
0x402030:           0x000000000040117a        0x0000000000401167
0x402040:           0x0000003c3b031b01        0xffffefe000000006
0x402050:           0xfffff00000000080        0xfffff010000000a8
0x402060:           0xfffff04000000058        0xfffff0f60000006c
```

⋮⋮

UnansweredQue   ✓   Quiz submitted

0 / 2 pts

At what address does the jump table start? [jmp_start]

Note: Answer in HEX, prefixing with 0x, and leaving off any leading 0s.

You Answered

Correct Answers

0x402008

402008

0x0000000000402008

0000000000402008

⋮⋮

UnansweredQuestion 27

0 / 2 pts

At what address does the code for the default case begin? [def_addr]

Note: Answer in HEX, prefixing with 0x, and leaving off any leading 0s.

You Answered

Correct Answers

0x40117a

40117a

0x000000000040117a

000000000040117a

⋮⋮

UnansweredQuestion 28

0 / 2 pts

How many non-negative cases use the default case?

○ 0

○ 1

○ 3

Correct Answer

○ A huge number

⣿
├─────────────────────────┤
│ ✓   Quiz submitted   │
└─────────────────────────┘

UnansweredQuestion 29

0 / 2 pts

Exactly one case fall through to another case. What is the address of the first line of code shared by both cases (falls through case and fallen into case)?

Note: Answer in HEX, prefixing with 0x, and leaving off any leading 0s.

You Answered

☐

Correct Answers

0x0000000000401162

0000000000401162

0x401162

401162

⣿

UnansweredQuestion 30

0 / 2 pts

How many entries are there in the jump table?

Note: Answer in decimal without leading 0s.

You Answered

☐

Correct Answers

7

0x7

seven

Seven

Quiz Score: 0 out of 100