Solution for Question Paper - Final Exams - Fall 2023

Course Code & Title: Computer Organization and Assembly Language

Program / Department: BS (CS)

Teacher’s Name: Asad Ullah Khan

Total Marks: 35

Question 1:

Basic Concept of Interrupts:

Definition: Interrupts are signals sent to the processor to indicate an event that needs immediate attention.

Signaling: Devices signal the processor through an interrupt request (IRQ) line. The processor recognizes the signal and pauses its current activities to address the interrupt.

Importance: Knowing who needs attention is critical for prioritizing tasks and ensuring timely responses to important events, such as input from peripherals or system errors.

Techniques for Performing I/O:

Programmed I/O: The processor actively waits and continuously checks the status of the I/O device, which can be inefficient.

Interrupt-Driven I/O: The device interrupts the processor when it is ready for data transfer, allowing the processor to perform other tasks.

Direct Memory Access (DMA): A DMA controller takes over the transfer of data directly between the I/O device and memory, freeing the processor to perform other tasks.

CLO 1, CLO 2

[2+3 Marks]

Question 2:

Examine the instruction sequence and show the values of the Carry (CF), Zero (ZF), and Sign (SF) flags where indicated.

assembly

mov al, 00001111b

test al, 00000010b ; a. CF=0 ZF=0 SF=0

mov al, 00000110b

cmp al, 00000101b ; b. CF=0 ZF=0 SF=0

mov al, 00000101b

cmp al, 00000111b ; c. CF=1 ZF=0 SF=1

CLO 3

[3 Marks]

Question 3:

Solve the following code and write the final value of EAX.

assembly

mov eax, 0

mov ecx, 15

L1:

mov eax, 5

mov ecx, 8

L2:

add eax, 10

loop L2

loop L1

Output:

assembly

EAX = 85

CLO 3

[4 Marks]

Question 4:

Examine the following high-level language code and write the assembly code (without using directives).

High-level code:

c

int array[] = {10602033728945657218};

int sample = 50;

int ArraySize = sizeof array / sizeof sample;

int index = 0;

int sum = 0;

while( index < ArraySize )

{

if( array[index] > sample )

{

sum += array[index];

}

index++;

}

Assembly code:

assembly

section .data

array dq 10602033728945657218

sample dd 50

sum dd 0

section .bss

index resd 1

ArraySize resd 1

section .text

global \_start

\_start:

mov eax, dword [array + 4]

mov ecx, sample

mov edx, sum

mov edi, index

check\_array:

mov esi, dword [array + edi\*4]

cmp esi, ecx

jle increment\_index

add edx, esi

increment\_index:

inc edi

cmp edi, 1

jl check\_array

mov [sum], edx

mov eax, 1

int 0x80

CLO 3

[8 Marks]

Question 5:

List three advantages and disadvantages of memory-mapped I/O compared with isolated I/O.

Advantages:

Simplified Addressing: Same address space for I/O and memory.

Faster Access: Direct access to I/O devices using regular memory instructions.

Ease of Use: No need for special I/O instructions.

Disadvantages:

Address Space Usage: Consumes part of the addressable memory space.

Potential Conflicts: Risk of memory and I/O address conflicts.

Security Issues: Easier for malicious code to access I/O devices.

CLO 1

[5 Marks]

Question 6:

Compare runtime stack with stack abstract data type:

Runtime Stack: Used by a program to manage function calls, local variables, and return addresses.

Stack Abstract Data Type: A data structure that follows Last In, First Out (LIFO) principle, used for various algorithm implementations.

Predict the value of ESP register when a 32-bit value is pushed on the stack:

Answer: ESP = ESP - 4

Explain what will happen if the RET instruction is omitted from a procedure:

Answer: The program may crash or exhibit undefined behavior as the execution will not return to the calling function, leading to stack corruption.

CLO 2, CLO 3

[2+2+2 Marks]

Question 7:

Find the value of AL after each shift or rotate instruction has executed:

assembly

mov al, 0D4h

shr al, 1 ; a. AL = 6Ah

mov al, 0D4h

sar al, 1 ; b. AL = 6Ah

mov al, 0D4h

sar al, 4 ; c. AL = 0Dh

mov al, 0D4h

rol al, 1 ; d. AL = A9h