COMSATS UNIVERSITY ISLAMABAD (CUI)

DEPARTMENT OF COMPUTER SCIENCE
TERMINAL EXAMINATION FALL - 2022
BS (CS) – 6R SEMESTER

Course: CSC-325 Computer Organization & Assembly Language
Instructor: *Taimur Shahzad*
Maximum Marks: 50
Dated: January 25, 2023
Time Allowed: 180 Minutes

- *All questions are self-explanatory and require no further explanations during exam time.*
- *Make sure that you have signed the attendance sheet before leaving the examination room.*
- *Return the question paper along with the answer sheet.*
- *Attempt all questions.*

(CLO – 1: Articulate the components of a computer along with its architecture)

QUESTION NO.01:

i. Differentiate between pipelined and non-pipelined processors. What is the advantage of pipeline over non pipelined execution? [05 Marks]

ii. Consider a pipeline having 4 phases with duration 60, 50, 90 and 80 ns. Given latch delay is 10 ns. Calculate-? [05 Marks]

(a) Non-pipeline execution time.
(b) Speed up ratio.
(c) Pipeline time for 1000 tasks.
(d) Sequential time for 1000 tasks.
(e) Throughput.

[10 Marks: 5+5]

(CLO – 2: Review memory systems and its hierarchy along with IO methods)

QUESTION NO.02:

i. Demonstrate the memory hierarchy of computer and define the concept of locality of reference in memory. [02 Marks]

ii. Consider a system having 32K bytes of main memory and 512 bytes of cache memory. The block size for both the memories is equal to 16 bytes. How many bits will be kept for offset, set number and tag bits for 8-way set associative cache? [05 Marks]

iii. Assume that a processor has a direct mapped cache, the physical address is 20 bits long, the tag is 12 bits, and each block holds 32 bytes of data. How many lines are in this cache? [05 Marks]
Let's say CPU sends requests for the following sequence of addresses:

0011 0101 0110 1101 1010, 0000 0011 1101 0111 0001, 1011 0101 0110 1101 0000,
1000 0000 1101 0111 0111, 1111 0010 0000 0000 1000, 1111 0010 0000 0001 0110,
1010 1010 1010 1100 0001, 1000 0000 1101 0111 0111

For each of the requests, state if it would result in a cache hit or a cache miss. Also show the final state of tag registers once all the requests have been entertained. Assume that the whole cache is free at the start.

[10 Marks: 2+3+5]

(CLO – 3: Compute the performance of CPU)

QUESTION NO.03:

i. While defining CPU performance which parameters are required to consider? Differentiate between CPU performance and execution time. Discuss factors affecting execution time. [05 Marks]

ii. You are on the design team for a new processor. The clock of the processor runs at 200 MHz. The following table gives instruction frequencies for a given program, as well as how many cycles the instructions take, for the different classes of instructions. [05 Marks]

Instruction Type	Frequency	Cycles
Loads and Stores	30%	6
Arithmetic instructions	50%	4
All others	20%	3

(a) Calculate the average CPI.

(b) If a given program gets executed in 11 seconds, calculate the number of instructions in a program.

(c) What clock rate would make the machine to execute the same program in 10 sec?

[10 Marks: 5+5]

(CLO – 4: Demonstrate assembly language programming capabilities)

QUESTION NO.04:

i. Using a loop and indexed addressing, write code that rotates the members of a 32-bit integer array forward one position. The value at the end of the array must wrap around to the first position. For example, the array. [05 Marks]

[10,20,30,40] would be transformed into [40,10,20,30].

ii. Write a non-recursive version of the Factorial procedure that uses a loop. Write a short program that interactively tests your Factorial procedure. Let the user enter the value of n. If overflow occurs in your loop when calculating each factorial value, your program should display an error message. If no overflow occurs, display the calculated factorial. [05 Marks]

[10 Marks: 5+5]

QUESTION NO.05:

i. Write an assembly code to convert a binary string, declared in data segment, into an unsigned value and store it in EAX register. For example, if the given string is '1110' the EAX register must have 14 in it. If the binary string is greater than 32 digits length, a value zero must be placed in EAX. (Hint: SHL and OR). [05 Marks]

ii. Write an assembly language procedure which will count the number of times vowel characters occur within a NULL terminated lowercase string. The procedure will be called with EDI having the address of the string to be searched and should return with the count in CX. For example, if the procedure is called for the following string, it must return 3 in CX:

```
str byte "hello world",0
```

The procedure should return with all registers preserved (except CX, which contains the return value). You are not allowed to refer to str variable inside the procedure. [05 Marks]

Note: A NULL terminated string is a sequence of ASCII characters with the end of the sequence indicated by a byte containing the value 0.

[10 Marks: 5+5]

*******BEST OF LUCK*******