Foundation Of Sequential Program CSC 218

**Reading Assignment**

**Inuwa Abdurrahman**

**(FSC/CSC/15/0088)**

**Question 1**

Explain *Computer Instruction Set Architecture*

**Question 2**

What are the two features that distinct *sequential program from concurrent program?*

**Question 3**

Why Von Neumann architecture is considered a *sequential machine?*

**Question 4**

*Briefly explain the three essential components in the stored computer program architecture*

**Question 5**

*How does the stored-computer computer architecture revolutionize computing?*

**Question 6**

*In computer, what do you understand by buses?*

**Question 7**

*Differentiate between Memory and Register*

**Question 8**

*Explain the Von Neumann Bottleneck. How do you prevent is?*

**Question 9**

*Mention any four types of MIPS Addressing modes and briefly explain one*

**Question 11**

*In how many passes does a Linker execute? Briefly explain them.*

**Question 10**

*Provide the MIPS equivalent of the following arithmetic expressions.*

1. a = b + c
2. x = z – y
3. p= (x + y) – (q + r)

**Q.1** Explain *Computer Instruction Set Architecture*

Computer Instruction Set Architecture is a segment of computer architecture that deals with computer programming aspects and defines how computing machine appears to a machine language programmer or compiler. The IS-A handles machine native data types, instructions, registers, addressing modes, memory architecture, interrupt and exception handling, and external I/O. Essentially, the instruction set provides commands to the processor. Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer (RISC) are two major instruction technologies found in many microprocessors.

* **Complex Instruction Set Computer (CISC)**

The main idea behind the CISC architecture is to complete/accomplish a task in the fewest lines of assembly language as possible. The processing hardware of CISC is built to understand and execute series of operations/instruction at hardware level.

* **Reduced Instruction Set Computer (RISC)**

Reduced Instruction Set Computer (RISC) is a popular microprocessor architecture that incorporated small and highly-optimized set of instructions. RISC based processors tend to minimise executable instructions within one clockcycle.

**Q.2:** What are the two features that distinct *sequential program from concurrent program?*

**The following are two features of a sequential Program that distincts it from concurrent program:**

1. The textual order of statements specifies their order of execution;
2. Statements (successive statements) must be executed in succession without overlap with one another.

**Q.3:** Why Von Neumann architecture is considered a *sequential machine?*

The Von Neumann Architecture is a typical example of sequential machine because the control unit allows execution of program one at a time.

**Q.4:** *Briefly explain the three essential components in the stored computer program architecture*

**Three Essential features from the architecture include:**

1. The Central Processing Unit (CPU)

The CPU which is the brain of a computer, is considered as the most important component in the architecture in which the Control Unit (CU), the Arithmetic Logic Units (ALU) and numerous Registers are housed.

1. Memory

The Memory in the architecture stores both program (sequence of instructions) and program data. Two kind of memories are widely used: Random Access Memory (RAM) and the Read-Only Memory (ROM). RAM loses it data when power is lost or when the program terminates i.e. it store data and program temporarily; ROM retains it data permanently because it stores initial boot up information.

1. Input/Output

The Input/Output Interfaces allow communications with external world communications could be with the user or secondary storage devices such as tapes and hard disks. The computer memory receives information (through the input interface) and send out information (through the output interface).

**Q.5:** *How does the stored-computer computer architecture revolutionize computing?*

Early computing machines were designed and built for a particular task. Programming of such machines requires the manual rewiring of circuits which is both tedious and error-prone task. This has made it extremely difficult to detect and correct errors. A revolutionary concept was proposed by Von Neumann which is based on the idea of storing both data and the program instructions that will operate on the data in a memory (RAM). This has solved the problems associated with earlier architectures and allows the integration of numerous circuits on a silicon wafers and the possibilities of mapping sophisticated algorithms onto the computer hardware.

**Q.6:** *In computer, what do you understand by buses?*

The *Bus(es)* is/are collections of signal lines that connects components together and allow for parallel transmission of information between various components in the architecture. Buses are numerous and perform different functions. Common examples are the address bus which identify memory location and I/O device; data bus which allow the bidirectional flow of program instructions and data between components and control bus that allow the CPU communicate with memory and I/O devices.

**Q.7:** *Differentiate between Memory and Register*

* Registers can be thought of as a special memory located inside the CPU; they are faster and more expensive than RAM.
* Number of registers is limited/negligible in comparison with memory space. Memory address in RAM is computable, while registers cannot be computed because they have fixed names [such as$3].
* RAM can be used to create large data structures while registers are best for small, fixed and fast storage mechanisms.

**Q.8:** *Explain the Von Neumann Bottleneck. How do you prevent is?*

Is the rate at which the CPU process instructions is far greater than the rate at which data/instructions move along the data bus thereby causing state of idleness in the CPU. This phenomenon is termed the Von Neumann Bottleneck.

The use of special memory known as cache. prevents Von Neumann bottleneck because there is no need of moving along the slow data bus in order to access main memory.

**Q.9:** *Mention any four types of MIPS Addressing modes and briefly explain one*

1. Register-indirect addressing
2. Immediate Addressing
3. Direct addressing
4. Based addressing

**Based addressing:-** based addressing is similar to indexed addressing. The only difference is that the base address is contained in a register.

**Q.10:** *Provide the MIPS equivalent of the following arithmetic expressions.*

1. a = b + c

The corresponding MIPS code: add $s0, $s1, $s2

1. x = z – y

The corresponding MIPS code: sub $s0, $s1, $s2

1. p= (x + y) – (q + r)

The corresponding MIPS code:

add t0, x, y # temp t0 = x + y

add t1, q, r # temp t1 = q + r

sub p, t0, t1 # p = t0 - t1

**Q.11:** *In how many passes does a Linker execute? Briefly explain them.*

Linker executes in two passes:

**Pass 1:** read in section sizes, compute final memory layout. Also, read in all symbols, create complete symbol table in memory.

**Pass 2:** read in section and relocation information, update addresses, write out new file.

*Program loaded into the memory is organized into segments, mention the numbers of segments and briefly explain each segment.*

Program loaded into the memory is organised into three segments of memory.

These segments are are:

1. **Text segment:-** text segment also known as the code segment is where the compiled code of the program is contained (in machine language form);
2. **Stack segment:-** the stack area automatically offers a storage area in the memory for variables within a program/function;
3. **Heap segment:-** provides more stable storage of data for a program. Memory allocated in the heap remains available for the entire execution period of the program. Heap segment store global variables and static variables.

**REFRENCE:**

* Isa Inuwa-Dutse: “CSC218 : FOUNDATION OF SEQUENTIAL PROGRAM LECTURE NOTE”; 2015/2016 Academic Session