**Quiz 4 Practice Questions**

**Notes 13:**

What is a struct?

Similar to an array, you access data within a struct by computing an offset from the base array

What are padding bits and what is it called when they are used?

Makes struct data retrieval from memory more efficient, when they are used it is called “default alignment.”

How is memory organized?

It is a two dimensional array that is four bites wide.

How is data retrieved from memory?

The entire word is retrieved, and the bytes that aren’t needed are ignored by the instructions

What happens when data is accessed inefficiently?

This happens when data is stored across two rows. The compiler is the required to make two reads instead of one.

What is endianness?

It is the order that bytes are stored in memory.

What is Big-endian and Little-endian?

Big-endian stores bytes in order (smallest address to largest address) and Little-endian stores bytes in backwards order (largest address to smallest address)

Write the value 0x12345678 in Big-endian and Little-endian.

Big-endian: 12345678

Little-endian: 78563412

Which endianness is better?  
 There is no performance difference between Big and Little endian.

What are the values of KB, KiB, MB, MiB, GB, GiB, TB, and TiB?

KB = 10^3, KiB = 2^10 = 1024, MB = 10^6, MiB = 2^20 = 1024^2, GB = 10^9, GiB = 2^30 = 1024^3, TB = 10^12, and TiB = 2^40 = 1024^4

**Notes 14:**

What are the steps required in procedure calling?

1. Place parameters in registers R0 – R3 2. Transfer control to procedure 3. Acquire storage for procedure 4. Perform procedure’s operations 5. Place result in register for caller 6. Return to place of call (address in R14)

What does BL (branch and link) do?

Address of following function goes in R14, and jumps to target address

What does BX LR (branch and exchange) do?

Copies LR to program counter (goes to address in LR).

What is the program counter and which register is reserved for it?

It holds the address that the program will move to next and it uses R15. If there is no branch, it will increment to next memory location.

What is the stack?

It is a LIFO queue where you can temporarily spill registers. It sits at the top of memory (High address). Addresses are added from the top down.

What is the stack pointer and what register is reserved for it?

It points to the most recently allocated stack address and sits at R13. Subtracting from SP grows the stack, adding to it shrinks it.

What registers can be used by the callee at will and which must be preserved?

R0 – R3 and R12 can be used at will and the callee must preserve R4 – R11 and R13 – R15.

How are registers preserved?

They are pushed to the stack.

What does an assembler do?

It translates a program into machine instructions.

In an object module, what are the following?

Header: described contents of object module

Text segment: translated instructions

Static data segment: data allocated for the life of the program

Relocation info: for contents that depend on absolute location of loaded program

Symbol table: global definitions and external refs

Debug info: for associating with source code

What does a linker do?

It produces an executable image by merging segments and resolving labels

What is dynamic linking?

You only link/load library procedure when it is called.

**Notes 15:**

What is pipelining?

Improving performance by increasing instruction throughput (overlapping execution), but can be subject to hazards.

What are the five stages of pipelining?

IF: Instruction fetch from memory, ID: Instruction decode & register read, EX: Execute operation or calculate address, MEM: Access memory operand, WB: Write results back to register

How many cycles does memory access take?

One cycle

What is a hazard, what types are there, and what do they mean?

A hazard is a situation that prevents starting the next instruction in the next cycle. Structure hazards mean that a required resource is busy, a data hazard means that the program needs to wait for a previous instruction to complete its data read/write, and a control hazard means that deciding a control action depends on a previous instruction

What is forwarding and when can you not use it?

This is using a result when it is computed as opposed to storing it in a register. You can’t use it when the value computed is not what we need.

What is a stall on branch?

This is when you have to wait until a branch outcome is determined before fetching the next instruction.

What is branch prediction, what are the two types, and what makes them different?

This is predicting the result of a branch. If incorrect, the only downside is that it produces a stall. Static branch prediction is based on typical branch behavior (ex: loop and if statement branches). Dynamic branch prediction measures branch behavior to predict it.

**Notes 16:**

What is a “fail”?

A fail means that a service can no longer meet its promises. It does not necessarily mean a crash.

What is a “fault,” and what are the types of faults?

A fault is a condition that can produce a failure. Types: transient – the fault occurs once and goes away, Intermittent – the fault occurs, disappears, and then reappears, permanent – the fault persists until the faulty component is replaced.

What is reliability?

Reliability is a measure of continuous service accomplishment.

What is MTTF?

Mean time to failure.

What is AFR?

Annual failure rate, percentage of devices that would fail every year given MTTF.

What is MTTR?

Service interruption is measured as mean time to repair

How do you calculate MTBF (mean time between failures)?

MTTF + MTTR

How do you calculate availability?

MTTF/(MTTF + MTTR)

What is the nines of availability?

One nine = 90% availability, two = 99% availability

What is reliability?

How long a component runs without failure.

What is error detection?

It checks for flipped bits. Passing an error check does not guarantee the data are intact thought.

What is error correction?

It repairs flipped bits.

What is parity?

It represents the number of ones in a bit pattern. Even number of ones means even parity and odd number means odd parity.

What is a parity bit?

A bit determining if the number of bits in a bit pattern is even or odd, found at either the beginning or end of bit pattern.

What is a CRC?

A cyclic redundancy check is a common error detection scheme that places a fixed length bit sequence at the end of a bit string.

What are Hamming codes?

It is an error correction sequence. Uses hamming distance to determine the number of bits that are different between two sequences.

How are data and parity bits placed in a CRC?

X X d X d d d X d d d d

Parity bits are placed at 20, 21, 22, and 23. Everything else is data.

What bits are each parity bit responsible for?

Bit 1: {1,3,5,7,9,11}

Bit 2: {2,3,6,7,10,11}

Bit 3: {4,5,6,7,12,13,14,15}

Bit 4: {8,9,10,11,12,13,14,15}