

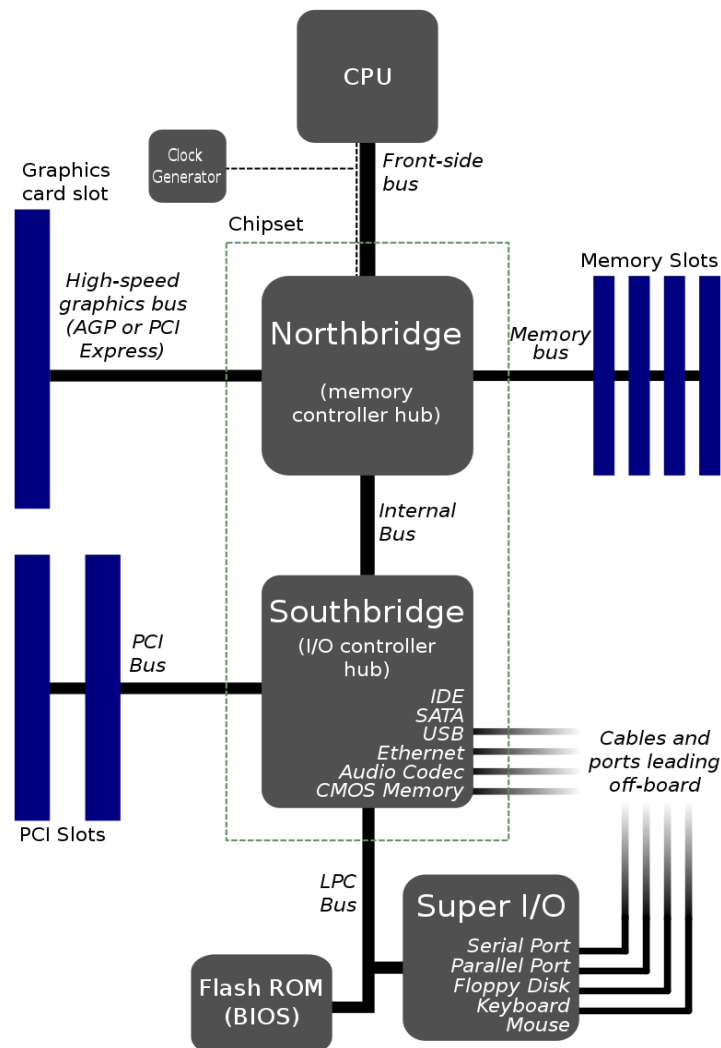
## FIT1047 PASS WEEK 6

PC Motherboard

Booting Process

BIOS and UEFI

Assignment 1: Boolean simplification



- Computer chipset - Northbridge & Southbridge (connected by internal bus)
- High priority components connect to **Northbridge** for higher speed
  - CPU
  - Memory slots - RAM
  - Graphic card
- Lower priority components connect to **Southbridge** via PCI bus & LPC bus
  - USB and I/O components
  - PCI Slots
  - BIOS

**In relation to CPU and I/O, tick the options that are True.**

- ☒ CPU needs to write data to I/O device
- ☒ CPU needs to read data from I/O device
- ☒ I/O devices have their own registers
- ☒ I/O devices are generally slower than CPU memory

**Bootting** means to load software step-by-step and activate all components one step after the other.

**Before Booting:**

Turn on power	<ul style="list-style-type: none"><li>• Components start working after stable power level</li><li>• <b>Power good</b> signal sent to motherboard to reset processor and starts clock tick</li></ul>
Initial software	<ul style="list-style-type: none"><li>• Reset command in CPU triggers execution of instruction at a specific location in BIOS chip</li><li>• Booting really starts with execution of this start-up program.</li></ul>

**Bootting Process:**

POST (Power-on-self-test)	<ul style="list-style-type: none"><li>• System memory is OK</li><li>• System clock/timer running</li><li>• Processor is OK</li><li>• Keyboard present</li><li>• Screen display memory working</li><li>• BIOS not corrupted</li></ul> <p>Results of POST communicated through system <i>beep</i> on devices starting with BIOS.</p>
Video card	<ul style="list-style-type: none"><li>• 1st thing after successful POST</li><li>• Initialise video card &amp; show initial message on screen</li></ul>
Other hardware	<ul style="list-style-type: none"><li>• Goes through all available hardware and initialise as far as possible without more complex driver software</li><li>• Example: Types and size of hard-disk, DVD drive, Timing of RAM, Networking &amp; Sound</li></ul>
Find Operating System	<ul style="list-style-type: none"><li>• BIOS needs to look for <i>bootable drive</i></li><li>• Order to check for anything bootable is defined in BIOS configuration</li></ul>
Boot sector	<ul style="list-style-type: none"><li>• Bootable drive must contain a boot sector with code that can be executed (boot loader).</li><li>• On a hard disk, this information is in <i>Master Boot Record</i> (MBR).</li><li>• Boot loader first loads the core parts of the OS (kernel), then it loads various modules, device drivers, etc.</li><li>• Once all drivers are loaded, Graphical User Interface (GUI) is started and personal settings are loaded.</li><li>• Computer is now ready to use.</li></ul>

**What does the abbreviation “POST” stand for in a computer's boot process? (1%)**

Power On Self Test

**BIOS starts with a \_\_\_\_.**

- a. Program
- b. POST**
- c. Operating system
- d. Initialisation

**The \_\_\_\_\_ is stored in ROM on the motherboard.**

- a. OS
- b. None
- c. I/O instructions
- d. Program code
- e. BIOS/UEFI**

**What is the first thing the BIOS will do after a successful POST? (1%)**

Initialise video card and show initial message on screen.

**Give one possible reason why 3D graphics are usually not available for firmware (BIOS/UEFI) configurations. (2%)**

- Drivers are not available before the OS is started.
- BIOS storage space is restricted

BIOS	UEFI
1024 kilobytes available space Works with up to <b>2.2 terabytes</b> hard-disks	Works with up to <b>9.4 zettabytes</b> hard-disks
<b>Slower</b> booting process - runs in 16-bit processor mode	<b>Faster</b> booting process - runs in 32-bits / 64-bits processor mode
<b>Slower</b> hardware initialisation - initiate 1 hardware at a time	<b>Faster</b> hardware initialisation - initialise multiple hardware at a time
<b>Not user-friendly</b> - no nice user interface	<b>User-friendly</b> - better UI configuration that has better graphics and supports mouse cursor
<b>Less secure</b> boot	<b>Better security</b> - Security and authentication features before OS has started
<b>No network access</b> before OS starts	<b>Network access</b> before OS starts

**Explain two restrictions for a PC during firmware (BIOS/UEFI) configurations, when compared to a PC running a full operating system.**

- The size of the BIOS is restricted to the size of the ROM or Flash chip. Therefore, functionality is restricted.
- Some components, such as printers, attached to the computer are not available before the OS starts. Only basic drivers for graphic cards are available. Thus, there is no fancy graphical user interface.

**Name two criticisms on UEFI:**

- Boot restrictions prevent users from installing OS of their choice.
- Additional complexity provides additional possibility for errors and new attack vectors.

**Assignment 1: How to simplify circuit using boolean laws referring to K-map.**

Given a truth table, simplify the circuit using both K-map and boolean laws.

A	B	C	Output
0	1	0	0
0	0	1	1
0	1	0	0
0	1	1	1
0	0	0	1
1	0	1	1
1	1	0	0
0	0	0	1

K-map grouping

		BC			
		00	01	11	10
A	0	0	1	1	0
	1	1	1	1	0

K-map solution:  $F(A, B, C) = AB' + C$

Boolean expression	Rule used
$A'B'C + A'BC + AB'C' + AB'C + ABC \rightarrow$ $A'B'C + A'BC + AB'C' + \mathbf{AB'C} + \mathbf{AB'C} + ABC$	Idempotent OR $A = A + A$
$A'B'C + A'BC + AB'C' + AB'C + AB'C + ABC \rightarrow$ $AB'C' + AB'C + A'B'C + A'BC + ABC + AB'C$	Commutative OR $A + B = B + A$
$AB'C' + AB'C + A'B'C + A'BC + ABC + AB'C \rightarrow$ $AB'(C' + C) + A'C(B' + B) + AC(B + B')$	Distributive OR $A(B + C) = AB + AC$
$AB'(C' + C) + A'C(B' + B) + AC(B + B') \rightarrow$ $AB'(1) + A'C(1) + AC(1)$	Inverse OR $A + A' = 1$
$AB'(1) + A'C(1) + AC(1) \rightarrow$ $AB' + A'C + AC$	Identity AND $1A = A$
$AB' + A'C + AC \rightarrow$ $AB' + C(A' + A)$	Distributive OR $A(B + C) = AB + AC$
$AB' + C(A' + A) \rightarrow$ $AB' + C(1)$	Inverse OR $A + A' = 1$
$AB' + C(1) \rightarrow$ $\mathbf{AB' + C}$	Identity AND $1A = A$

$$F(A, B, C) = (A + B + C')(A + B' + C')(A' + B + C)(A' + B + C')(A' + B' + C')$$

	$B + C$	$B + C'$	$B' + C'$	$B' + C$
$A$	1	0	0	1
$A'$	0	0	0	1

Product of sum:  $F = (A' + B) C'$

K-map we get  $(A' + B) C'$

Date : \_\_\_\_\_

$$F(A, B, C) = (A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + C)(\bar{A} + B + \bar{C})(\bar{A} + \bar{B} + \bar{C})$$

TIP: duplicate overlapping K-map elements in groups!

① Using Idempotent to create more terms needed. ( $X = X \cdot X$ )

$$(A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + C)(\bar{A} + B + \bar{C})(\bar{A} + B + \bar{C})(\bar{A} + \bar{B} + \bar{C})$$

② Group common ones (rearrange w/ commutative) ( $AB = BA$ )

$$(\bar{A} + B + C)(\bar{A} + B + \bar{C})(A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + \bar{B} + \bar{C})(\bar{A} + B + \bar{C})$$

③ Distributive AND to simplify

$$[(\bar{A} + B) + C\bar{C}] \cdot [(A + \bar{C}) + B\bar{B}] \cdot [(\bar{A} + \bar{C}) + B\bar{B}]$$

④ Further simplify w/ inverse AND & identity OR

$$(\bar{A} + B) \cdot (A + \bar{C}) \cdot (\bar{A} + \bar{C})$$

$$(\bar{A} + B) \cdot \bar{C} (A + \bar{A})$$

$$(\bar{A} + B) \bar{C}$$