Paper 102: Programming & Problem solving through C

Lecture-24:Keyboard basics

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Operation of keyboard

- The keyboard unit contains a dedicated microprocessor
- The keyboard microprocessor contains a bufer that can store keys that are hit
- The main task of this microprocessor is to watch the keys and report to the main computer whenever a key is press or released
- If any key is pressed continuously, it sends a repeat action
  - If a key is pressed for more than 0.5 seconds it causes an auto repeat action to begin, and the repeat rate is 10 characters per seconds
- This 0.5 secs is called ‘typematic delay’ and the repeat action that follows is called ‘typematic rate’

Cont…

- Each time a key is pressed, the keyboard circuits transmit a sequence of one or more 8-bit numbers to the computer
  - Scan code
- The keyboard produce different scan codes depending whther the key is pressed or released
  - Scan code between 1 and 83 when a key is pressed
  - When a key is released a scan code is 128 higher than the scan code generated when key is pressed
    - Letter ‘A’ has scan code 30, when released, it generates scan code 158(128 + 30)
- The keyboard controller generates an interrupt every time it receives a scan code from the keyboard

ROM BIOS

- The ROM BIOS contains the corresponding routines which reads this scan code from the keyboard controller and then process it
- It translates scan code as a two byte sequence
  - First byte-ASCII value
  - Second byte-scan code
- If alphabets, digits, special symbols are press, the first byte contains an ASCII value else a zero
- It places the byte pair in a queue, kept in low memory
- It also uses a buffer than can usually store about 15 keys, but this can be change by the system

Shift keys

- The translation is done by first checking the status of the shift and toggle keys
- The Ctrl, Shift and Alt keys are called as Shift keys
- They change the shift state of other keys pressed along with them
  - Shift a- A
  - Alt 65 in numeric pad- A

Toggle keys

- Caps-lock and Num-lock are called as toggle keys
- They also affects the keyboard's shift state
- When caps-lock is pressed, it reverses the state of the alphabet keys pressed
- Num-lock disables the cursor control functions of the numeric keypad
- They are activated with a single keystroke and released by another keystroke

Bit settings

- The shift key and toggle key information are kept by the ROM BIOS in memory locations 0x417 and 0x418
- The bits of byte 0x417 keep tracks of status of the keys

0x417

Bit numbers								Meaning
7	6	5	4	3	2	1	0	
1								Insert state
	1							Caps lock
		1						Num lock
			1					Scroll lock
				1				Alt pressed
					1			Ctrl pressed
						1		Left Shift pressed
							1	Right Shift pressed

Bit settings

- The bits of byte 0x418 monitor whether keys are pressed or not

0x418

Bit numbers								Meaning
7	6	5	4	3	2	1	0	
1								Insert pressed
	1							Caps lock pressed
		1						Num lock pressed
			1					Scroll lock pressed
				1				Hold state active
					1			Sys Req key pressed
						1		Left Alt key pressed
							1	Right Alt key pressed

Steps performed by ROM BIOS when a key ‘Shift a’ is pressed

- Since shift is pressed it puts ON the bit in 0x417
- Having received the scan code of ‘a’ it does the following
  - Check the status of shift key from byte 0x418, if ON it puts the ASCII value in the memory
- The moment the shift key is released, the scan code sets the bit for shift key in byte 0x417 to OFF
- Keys like Insert, Caps-lock, Num-lock and Scroll-lock has 2 bits to store information, one bit in each byte
  - The bit in 0x417 indicate on or off
  - The bit in 0x418 indicate if it is currently pressed or not
- Hence when ROM BIOS receives the scan code for an ordinary keystroke it first check the status of shift key and the translate into a two byte code

Key combinations

- While ROM BIOS is translating scan codes, it checks for certain key combinations
  - CTRl-Alt-Del, Ctrl-Break, etc…
  - These combinations causes the ROM-BIOS to perform specific task
    - Reboots the system, print content of the screen on the printer

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