

ENGG1003 - Friday Week 1

Algorithms and Pseudocode

Brenton Schulz

University of Newcastle

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Algorithms

- ▶ Informally, an *algorithm* is a series of steps which accomplishes a task
- ▶ More accurately, the steps (instructions) must:
 - ▶ Have a strict order
 - ▶ Be unambiguous
 - ▶ Be executable
- ▶ “Executable” means that the *target platform* is capable of performing that task.
 - ▶ eg: An industrial welding robot can execute “move welding tip 1 cm left”. A mobile phone can’t.

Algorithms

- ▶ An algorithm exists purely as an abstract concept until it is communicated
- ▶ We will use:
 - ▶ *Pseudocode* to communicate algorithms to ourselves and other people
 - ▶ The languages C and MATLAB to communicate algorithms to computers
- ▶ Pseudocode can be very formal, as engineers we will only use formal rules if required
 - ▶ eg: When documenting algorithms for other people
 - ▶ Your own “working out” can be anything that helps *you*

Algorithm Example 1

Example 1: Algorithm given to mum to start my car (2015 Toyota Tarago)

Result: The vehicle's engine is idling

Initialisation: stand next to the vehicle, key fob in hand

1. Depress the unlock button on the key fob, car will beep twice
2. Place key fob in your pocket
3. Enter the vehicle, sit in the driver's seat
4. Ensure that the gear selector has P engaged
5. Depress the brake pedal
6. Observe that the green LED is lit on the engine start button
7. Press the engine start button
8. If engine is not idling

▶ Call me

Example Discussion

- ▶ Algorithms typically need to feel over-explained
 - ▶ Computers are *really stupid*; get in the habit of over-thinking everything
- ▶ The algorithm contained *flow control*
 - ▶ The final step (“call me”) was *conditional* on the car not starting
- ▶ We will discuss *Boolean logic* later, but first...

Algorithm Example 2

A wife asks her husband, a programmer, “Could you please go shopping for me and buy one carton of milk, and if they have eggs, get 6?”

A short time later the husband comes back with 6 cartons of milk and his wife asks, “Why did you buy 6 cartons of milk?”

He replies, “They had eggs.”

Algorithm Example 2a

A wife asks her robot helper, “Could you please go shopping for me and buy one carton of milk, and if they have eggs, get 6?”

The robot replies: “Unknown instruction: ‘get 6’. ”

Boolean Logic

- ▶ Computers don't understand “maybe”
- ▶ A *condition* on execution must be absolutely **true** or **false**
- ▶ Boolean logic (or Boolean algebra) is a field of mathematics which evaluates logical statements as either true or false
- ▶ Boolean logic defines three *operators*:
 - ▶ OR
 - ▶ AND
 - ▶ NOT

C listing template

```
1 #include <stdio.h>
2 int main() {
3     printf("Custom listing template\n");
4 }
```

```
#include <stdio.h>
int main() {
    printf("default C style\n");
}
```

Columns Template

right side

left side

```
brenton@brenton-Lenovo-ideapad-5205-14IKB: /usr/share/hunspell
brenton@brenton-Lenovo-ideapad-5205-14IKB: /usr/share/hunspell 80x24
[99315.136504] usb 1-7: reset full-speed USB device number 3 using xhci_hcd
[99315.221506] ata1: SATA link up 6.0 Gbps (SStatus 133 SControl 300)
[99315.276562] usb 1-5: reset high-speed USB device number 2 using xhci_hcd
[99315.523947] OOM killer enabled.
[99315.523949] Restarting tasks ... done.
[99315.529326] PM: suspend exit
[99316.774373] [drm] RC6 on
[99320.358150] ata1.00: qc timeout (cmd 0xec)
[99320.358172] ata1.00: failed to IDENTIFY (I/O error, err_mask=0x4)
[99320.358178] ata1.00: reset failed (errno=-5)
[99320.678561] ata1: SATA link up 6.0 Gbps (SStatus 133 SControl 300)
[99320.673416] ata1.00: configured for UDMA/133
[99320.845235] IPv6: ADDRCONF(NETDEV_UP): wlp2s0: link is not ready
[99321.595422] IPv6: ADDRCONF(NETDEV_UP): wlp2s0: link is not ready
[99321.644706] IPv6: ADDRCONF(NETDEV_UP): wlp2s0: link is not ready
[99326.549930] wlp2s0: authenticate with 40:9b:cd:28:a3:90
[99326.588140] wlp2s0: send auth to 40:9b:cd:28:a3:90 (try 1/3)
[99326.589777] wlp2s0: authenticated
[99326.591943] wlp2s0: associate with 40:9b:cd:28:a3:90 (try 1/3)
[99326.595543] wlp2s0: RX AssocResp from 40:9b:cd:28:a3:90 (capab=0x431 status=0
aid=1)
[99326.598023] wlp2s0: associated
[99326.605174] IPv6: ADDRCONF(NETDEV_CHANGE): wlp2s0: link becomes ready
brenton@brenton-Lenovo-ideapad-5205-14IKB: /usr/share/hunspell [1]
```