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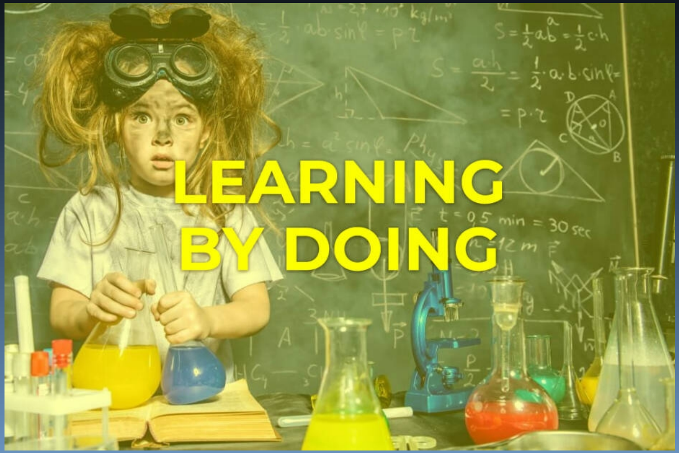
Snake Game



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Aristotle, The Nicomachean Ethics

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Richard Branson, Virgin Group

Summary

- Why this game?
- Prerequisites
- Different development steps
  - Flow control
  - Variables and constants
  - Predefined functions
  - Arrays
  - Functions
  - I/O

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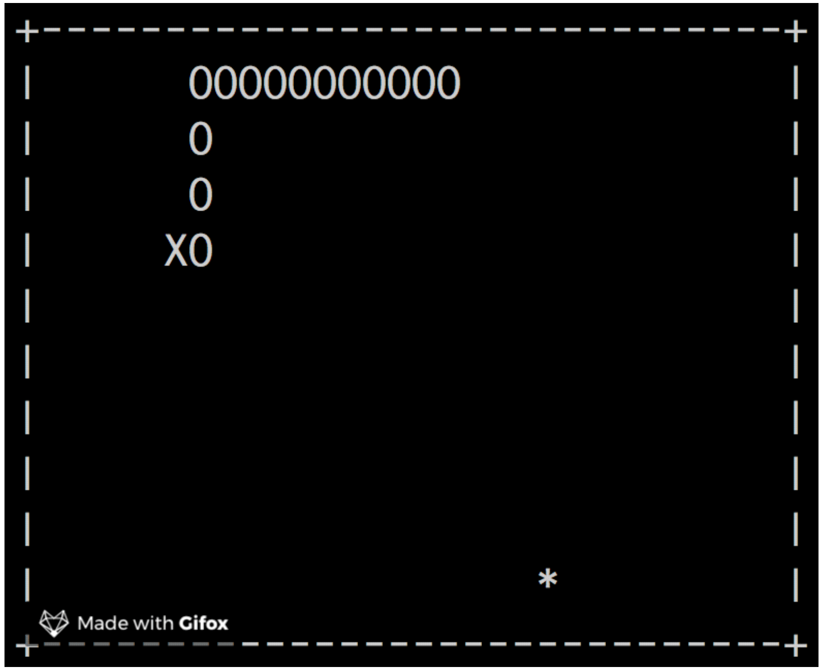
  - Back to '70s
- Please note that these slides will be continuously updated!



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|       00000000000           |
|       0                     |
|       0                     |
|      X0                     |
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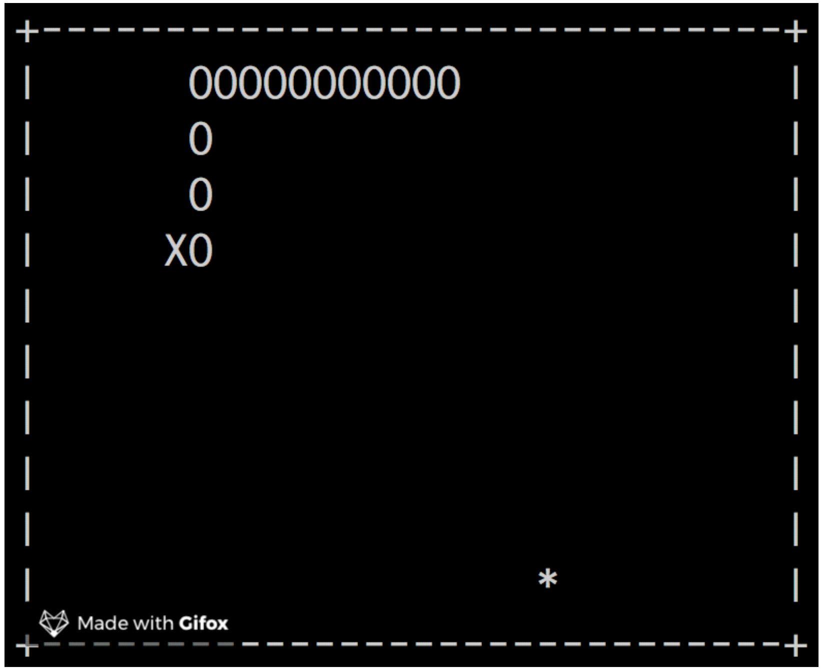
- What is the snake progam?
- It is a simple game that can easily be rendered using only the console (1976)
- The player control a "snake" that is continuously moving
- Each time the "head" of the snake "eat" some "food", the snake itself grows becoming longer and longer
- When the snake hits the "walls" or itself it is a game over!



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Prerequisites

- Even console “graphics” can be difficult
- 2 main issues:
  - In a game I would like to read keypresses without stopping the program
    - scanf() and other console input functions stops until a “return” is entered…
  - I also would like to be able to write in a given position
    - printf() and other console output functions can not behave like this…

Prerequisites

- We will start from a C “skeleton” that contains specific functions to solve those issues
- Therefore:
  - Create a “snake” project in your folder (U:\ for Lab workstations)
  - Overwrite the main.c in your project with the skel.c in the “snake” folder in the lab repository
  - Try to compile & run

10. Flow control: selection

- Print a menu like:
  1. Start game
  2. Scores
  3. Help
  4. Quit
- Read from keyboard the user choice

10b. Flow control: selection

- Print the choice (as debug) and act as follows
  - Help:
    - Print “Q: left, E: right, W: up, S: down, ‘space’: pause, X: quit”
  - Quit: end the program
  - Scores: do nothing for now
  - Start: go on to the next slide
- What is the best selection statement to use?

20. Flow Control: cycles

- Modify step #10 in order to print again the menu:
  - When the user enters a wrong choice
  - After the help
  - Later, also after the start…
- When the user enters the “start” go on according to next slides

20b. Flow Control: cycles

- Print the game field
- Namely, a **23×97** rectangle surrounded by a border
  - Use '+' for corners
  - Use '-' for horizontal borders
  - Use '|' (ASCII 124) for vertical borders
- Use a top down approach!

20b. Flow Control: cycles

- Hints for printing the playing field
  - Do not stick on a given size for the field
    - Put the 23 and 97 in variables → "generalize" your approach
  - Use a top down approach
    - Imagine yourself driving down the field using the limitations of the printf()
    - What we have to write initially? And then? How many times?
- Questions:
  - How many cycles do we need?
  - Do we need to nest some cycles?

30. Variables & Constant

- Use a variable for the score and init it to zero
  - What is the best type to use?
- Modify 20#:
  - Print the score before the playing field using 6 characters and using zero as padding character
  - Use constants for the symbols used for the border of the playing field
  - Use constants for the size of the playing field
- Define also variables for the snake head position and heading
  - Initialize them with random values
  - Which kind of variables do we have to use? How many?

40. Predefined functions: usleep()

- Study the following functions (on the book!)

  #include <unistd.h>

  int usleep(usec);

- It stops the program execution for usec µs (1 µs = 1000 ms)
- It can be used during the game (later)

40. Predefined functions

- In the skeleton you can find other functions
- They are **NOT** C predefined functions
- But they have been already fully defined
- Then we can use them as predefined functions anyway

40. “Predefined” functions: clearscreen()

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```
void clearscreen(void)
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- It “clears” the console
- Then it can be used when starting the program, when switching back to the menu after playing, …

40. “Predefined” functions: gotoxy()

void gotoxy(int, int)

- When using printf() and similar functions, the output is written in a constrained position in the console
  - “printing cursor” position
  - From left to right, from the top to bottom
- In a game I have to be more free about printing position
- The gotoxy() function allow to move the cursor in a given position
  - row and column coordinates
  - The top-left position in the console has (∅, ∅) coordinates
  - Column index increases moving right
  - Row index increases moving down

40. “Predefined” functions: getcommand()

char getcommand(void)

- scanf() and similar keyboard input functions “stop” the execution
  - They wait for a “enter/return”
- In a game we need to be able to read keystrokes in a non blocking fashion
- getcommand() returns the ASCII value of a key that has been pushed or 0 if no key has been stroke

50. Start the game!

- In #30 you defined and randomly initialized the variables for storing the snake position and movement
- Exploiting the gotoxy() functions:
  - Write the snake head 'X' in the console!

60. Update the game!

- After printing the playing field & the snake head:
  - Use an infinite loop for continuously updating the console
  - Each cycle:
    - Update the snake head position according to the randomly chosen direction where the snake is heading
    - Check whether the snake hits a border, in such a case exit the infinite loop
- Which instructions I can use for an “infinite” loop?
- How can I exit such a loop?

60. Update the game! (2)

- In #30 you should have defined which kind of variables to use for storing snake head position and its heading
  - For position it is fine to use 2 variables for the 2 coordinates
  - But what is the best way to store the direction where the snake is heading?
- Most of you use a single variable to encode the direction
  - e.g. 1 for heading left, 2 for right etc.

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- This choice can be effective but it is not so efficient
  - Each time we have to "transcode" the value
- Alternative solution:
  - The heading can be seen as a vector
  - Encode horizontal & vertical components
    - Pros:
      - Movements $\longrightarrow$ directly encoded
      - Change of direction $\longrightarrow$ easy
    - Cons:
      - We need 2 variables

60. Update the game! (3)

- A simple 90° rotation, can be used to update the ſtate when a "turn" is requeſted

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70. read the input

- Use the char getcommand(void) function to read the keyboard input
- Move the snake head accordingly:
  - Q: left
  - E: right
  - W: up
  - S: down

80. add some food & poison

- Randomly (i.e. not each cycle) add some food ('#') and some poison ('Y') in a random position (i.e. random column/row) in the playing field
- Increase/Decrease the player score when the snake head get it!
- Just one piece of food and one piece of poison (until the snake eats it!)

90. arrays: add snake body

- When the snake head hits the food:
  - Food must be removed from the playing field
  - A snake body grows… "OOOOO"
    - Initially no body
    - Each time he gets food add a piece of body 'O'
- For poison implement an opposite behavior
- Use arrays for dealing with the body
  - A single array or multiple ones and what size?
  - Which kind of data I need?
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100. Dynamic memory allocation

- Use a dynamically allocated array to deal with snake body
  - Use malloc() to allocate first body piece
  - Use realloc() to grow/reduce it piece by piece
  - Use free() when the game ends

120. User-defined functions

- Factorize your code using functions, e.g.:
  - menu()
  - printfield()
  - printsnake()
  - putfood()
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  - updatefield()
  - …
- Barely nothing other than function invocations in the main()!

130. files

- When a game session ends, ask the user about his nickname and save the score in a CSV files, like
  - Nickname;date;score
  - Use an “append” strategy for saving data
- When user select “S” from Menu
  - Print:
    - Last score
    - Best score

140. ſtruct

- Add ſtruct to your code
  - i.e. for managing snake data
  - Does this simplify function calls?

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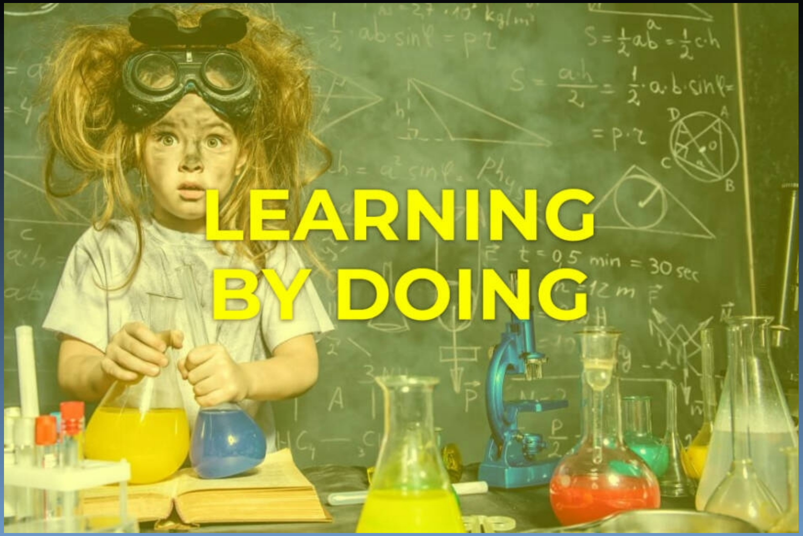
The End (so far...)



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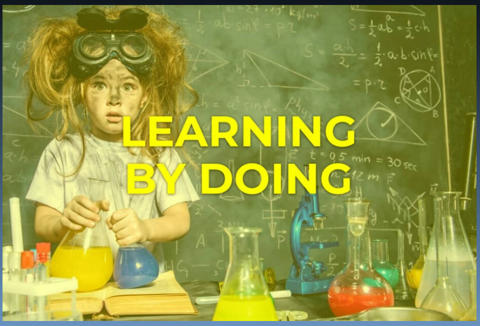

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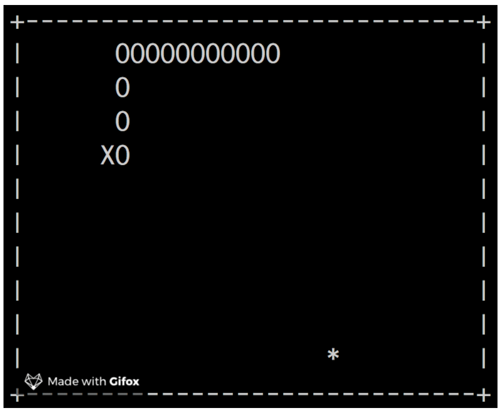

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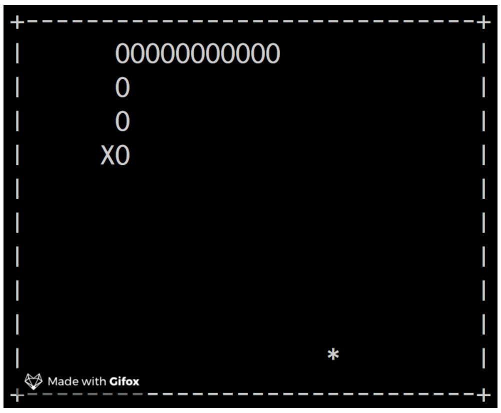

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