

## OCaml

Basic syntax and semantics - 0

Summary: In this first OCaml module, you will discover the basic syntax and semantics of the language: values, types, operators, let bindings, functions and recursion.

Version: 1.00

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#### Chapter I

#### Foreword

Black metal is an extreme subgenre and subculture of heavy metal music. Common traits include fast tempos, a shrieking vocal style, highly or heavily distorted guitars played with tremolo picking, raw (lo-fi) recording, unconventional song structures and an emphasis on atmosphere. Artists often appear in corpse paint and adopt pseudonyms.

During the 1980s, several thrash and death metal bands formed a prototype for black metal. This so-called first wave included bands such as Venom, Bathory, Mercyful Fate, Hellhammer and Celtic Frost. A second wave arose in the early 1990s, spearheaded by Norwegian bands such as Mayhem, Darkthrone, Burzum, Immortal and Emperor. The early Norwegian black metal scene developed the style of their forebears into a distinct genre. Norwegian-inspired black metal scenes emerged throughout Europe and North America, although some other scenes developed their own styles independently.



Figure I.1: Abbath from the Norwegian black metal band Immortal

#### Chapter II

#### General rules

- Your project must be realized in a virtual machine.
- Your virtual machine must have all the necessary software to complete your project.
   These softwares must be configured and installed.
- You can choose the operating system to use for your virtual machine.
- You must be able to use your virtual machine from a cluster computer.
- You must use a shared folder between your virtual machine and your host machine.
- During your evaluations you will use this folder to share with your repository.
- Your functions should not quit unexpectedly (segmentation fault, bus error, double free, etc) apart from undefined behaviors. If this happens, your project will be considered non functional and will receive a 0 during the evaluation.
- We encourage you to create test programs for your project even though this work won't have to be submitted and won't be graded. It will give you a chance to easily test your work and your peers' work. You will find those tests especially useful during your defence. Indeed, during defence, you are free to use your tests and/or the tests of the peer you are evaluating.
- Submit your work to your assigned git repository. Only the work in the git repository will be graded. If Deepthought is assigned to grade your work, it will be done after your peer-evaluations. If an error happens in any section of your work during Deepthought's grading, the evaluation will stop.

#### Chapter III

#### OCaml modules, general rules

- Every output goes to the standard output, and will be ended by a newline, unless specified otherwise.
- The imposed filenames must be followed to the letter, as well as class names, function names and method names, etc.
- Unless otherwise explicitly stated, the keywords open, for and while are forbidden. Their use will be flagged as cheating, no questions asked.
- Turn-in directories are ex00/, ex01/, ..., exn/.
- You must read the examples thoroughly. They can contain requirements that are not obvious in the exercise's description.
- You are only allowed to use the OCaml syntaxes you learned about since the OCaml module 00 up this current module or project. You are not allowed to use any additional syntax, modules and libraries unless explicitly stated otherwise.
- The assignments must be done in order. The graduation will stop at the first failed assignment.
- Read each exercise FULLY before starting it! Really, do it.
- The compiler to use is ocamlopt. When you are required to turn in a function, you must also include anything necessary to compile a full executable. That executable should display some tests that prove that you've done the exercise correctly.
- Remember that the special token ";;" is only used to end an expression in the interpreter. Thus, it must never appear in any file you turn in. Regardless, the interpreter is a powerfull ally, learn to use it at its best as soon as possible!
- No coding style is enforced during the OCaml piscine. You can use any style you like, no restrictions. Keep in mind that a code your peer-evaluator can't read is a code he or she can't grade. As usual, big functions are a weak style.
- You will NOT be graded by a program, unless explictly stated in the subject. Therefore, you are given a certain amount of freedom in how you choose to complete the assignments. However, some OCaml modules might explicitly cancel this rule, and you will have to respect directions and outputs perfectly.

- Only the requested files must be turned in and thus present on the repository during the peer-evaluation.
- Even if the subject of an exercise is short, it's worth spending some time on it to be absolutely sure you understand what's expected of you, and that you did it in the best possible way.
- By Odin, by Thor! Use your brain!!!

#### Chapter IV

### Day-specific rules

For this day, you must respect directions and outputs perfectly. A single character mismatch means that the exercice is wrong, althought you are still free to wrap these outputs as you wish. For instance, the first exercice of the days expects the words "positive" or "negative" followed by a new line. You made three tests to prove your work:

This output is right:

```
$> ocamlopt ft_test_sign.ml
$> ./a.out
positive
positive
negative
$>
```

This output is also right:

```
$> ocamlopt ft_test_sign.ml
$> ./a.out
Test with [42]: positive
Test with [0]: positive
Test with [-42]: negative
$>
```

This output is WRONG:

```
$> ocamlopt ft_test_sign.ml
$> ./a.out
positive positive negative
$>
```

This output is also WRONG:

```
$> ocamlopt ft_test_sign.ml
$> ./a.out
Test with [42]: [positive]
Test with [0]: [positive]
Test with [-42]: [negative]
$>
```

### Chapter V

## Exercise 00: ft\_test\_sign

	Exercise 00	
	Exercise 00: ft_test_sign	
Turn-in directory : $ex00/$		
Files to turn in: ft_test_sign.ml		
Allowed functions: print_endline		/

Write a function ft\_test\_sign of type int -> unit that displays "positive" or "negative" followed by a new line, depending on the sign of the parameter. O is always considered positive.

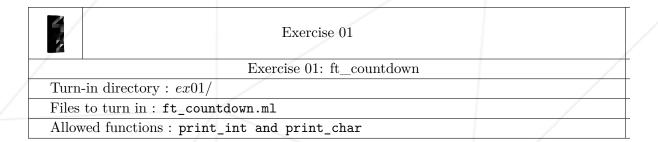
Exemples in the interpreter:

```
# ft_test_sign 42;;
positive
- : unit = ()
# ft_test_sign 0;;
positive
- : unit = ()
# ft_test_sign (-42);;
negative
- : unit = ()
#
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.

### Chapter VI

#### Exercise 01: ft\_countdown



Write a function ft\_countdown of type int -> unit that displays a countdown from the parameter's value down to 0 and a new line after each value. If the value is negative, just display 0 and a new line.

Exemples in the interpreter:

```
# ft_countdown 3;;
3
2
1
0
-: unit = ()
# ft_countdown 0;;
0
-: unit = ()
# ft_countdown (-1);;
0
-: unit = ()
#
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.

### Chapter VII

### Exercise 02: ft\_power

	Exercise 02	
/	Exercise 02: ft_power	/
Turn-in directory : $ex02/$		
Files to turn in: ft_power.ml		
Allowed functions: Nothing		

Write a function ft\_power of type int -> int -> int that returns first parameter power the second parameter. Both parameters will always be positives or equal to 0, but both will never be equal to 0 at the same time.

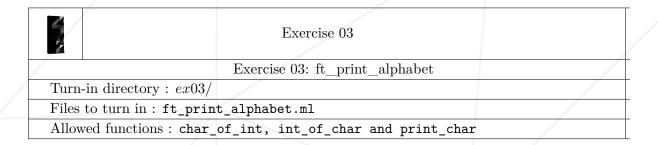
Exemples in the interpreter:

```
# ft_power 2 4;;
-: int = 16
# ft_power 3 0;;
-: int = 1
# ft_power 0 5;;
-: int = 0
#
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.

### Chapter VIII

#### Exercise 03: ft\_print\_alphabet



Write a function ft\_print\_alphabet of type unit -> unit that displays the alphabet on a single line followed by a new line.

Exemple in the interpreter:

```
# ft_print_alphabet ();;
abcdefghijklmnopqrstuvwxyz
- : unit = ()
#
```

Be sure to provide a tests suite to prove that your funciton works as intended during peer-evaluation ("tests suite" might be a little bit of an over-statement here). Obviously, printing 26 chars one after the other will be considered cheating. You are allowed only one use of print\_char in the exercice excluding the print\_char for the newline at the end of input.

#### Chapter IX

# Exercise 04: ft\_print\_comb

	Exercise 04	
/	Exercise 04: ft_print_comb	
Turn-in directory : $ex04/$		
Files to turn in : ft_prin	t_comb.ml	/
Allowed functions : print	_int and print_string	/

Write a function ft\_print\_comb of type unit -> unit that displays in ascending order all the different combinaisons of 3 digits, each digit different from the 2 others, and the 3 digits also in ascending order. Each combinaison is separated from the next one by a comma and a space. Finish your display by a new line.

You must have something that starts an finishes that way:

```
# ft_print_comb ();;
012, 013, 014, 015, 016, 017, 018, 019, 023, <more numbers>, 789
- : unit = ()
#
```

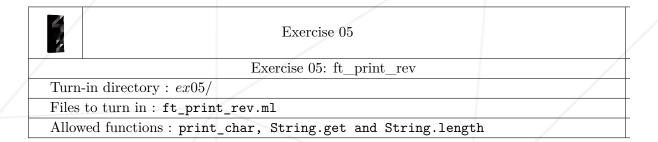
As additional informations, 987 is not part of the sequence because 789 is already part of it. Also note that for instance, 999 is not part of the sequence because the 3 digits are not different from the 2 others.

Displaying the right answer in a big string without actually computing it will be treated as cheating during the peer-evaluation.

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation ("tests suite" might be a little bit of an over-statement here as well).

## Chapter X

### Exercise 05: ft\_print\_rev



Write a function ft\_print\_rev of type string -> unit that prints its string parameter in reverse order, one character at a time, ending with a new line.

Exemple in the interpreter :

```
# ft_print_rev "Hello world !";;
! dlrow olleH
- : unit = ()
# ft_print_rev "";;
- : unit = ()
#
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.



### Chapter XI

#### Exercise 06: ft\_string\_all

	Exercise 06	
/	Exercise 06: ft_string_all	/
Turn-in directory : $ex0$	6/	
Files to turn in : ft_st	ring_all.ml	
Allowed functions : Str	ring.get and String.length	

Write a function ft\_string\_all of type (char -> bool) -> string -> bool. To help you get on tracks, the first parameter, of type char -> bool, is a function. As this function returns a bool, it can therefore be refered to as a "predicate" function.

So, the function ft\_string\_all takes a predicate function and a string as parameters, and applies each character of the string to the predicate function. If the predicate is true for every character of the string, ft\_string\_all returns true. Otherwise, if the predicate function is false for at least one character, ft\_string\_all returns false.

Exemples in the interpreter:

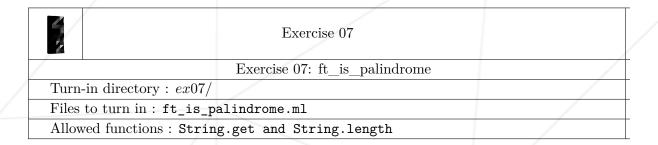
```
# let is_digit c = c >= '0' && c <= '9';;
val is_digit : char -> bool = <fun>
# ft_string_all is_digit "0123456789";;
- : bool = true
# ft_string_all is_digit "012EAS67B9";;
- : bool = false
#
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.



## Chapter XII

### Exercise 07: ft\_is\_palindrome



Write a function ft\_is\_palindrome of type string -> bool that returns true if the string parameter is a palindrome character by character, false otherwise. If you intend to use your previous function ft\_string\_all, please embed its code in the file ft\_is\_palindrome.ml as well. The empty string is a palindrome.

Exemples in the interpreter:

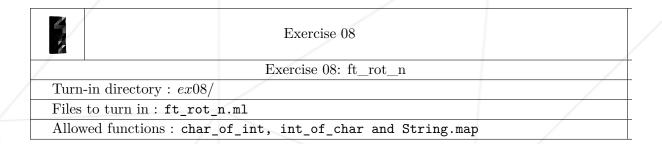
```
# ft_is_palindrome "radar";;
- : bool = true
# ft_is_palindrome "madam";;
- : bool = true
# ft_is_palindrome "car";;
- : bool = false
# ft_is_palindrome "";;
- : bool = true
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.



### Chapter XIII

#### Exercise 08: ft\_rot\_n



Write a function ft\_rot\_n of type int -> string -> string. Let n the first parameter and str the second parameter, ft\_rot\_n rotates each lower case and upper case alphabetical characters of str of n in acsending order. The value n will always be positive.

Exemples in the interpreter:

```
# ft_rot_n 1 "abcdefghijklmnopqrstuvwxyz";
-: string = "bcdefghijklmnopqrstuvwxyz";
# ft_rot_n 13 "abcdefghijklmnopqrstuvwxyz";;
-: string = "nopqrstuvwxyzabcdefghijklm"
# ft_rot_n 42 "0123456789";
-: string = "0123456789";
-: string = "012EAS67B9";;
-: string = "QK2GCU67D9"
# ft_rot_n 0 "Damned !";;
-: string = "Damned !"
# ft_rot_n 42 "";;
-: string = ""
# ft_rot_n 1 "NBzlk qnbjr !";;
-: string = "OCaml rocks !"
```

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation.



### Chapter XIV

#### Exercise 09: ft\_print\_comb2

5	Exercise 09	
	Exercise 09: ft_print_comb2	
Turn-in directory : $ex09$	1	
Files to turn in : ft_print_comb2.ml		
Allowed functions : prin	nt_char, print_int	/

Write a function ft\_print\_comb2 of type unit -> unit that displays each unique combinaisons of two numbers, each one between 00 and 99, in ascending order. Each combinaison is separated from the next one by a comma and a space. Finish your display by a new line.

You must have something that starts an finishes that way:

```
# ft_print_comb2 ();;
00 01, 00 02, 00 03, 00 04, 00 05, <more numbers>, 00 99, 01 02, <more numbers>, 97 99, 98 99
- : unit = ()
#
```

Displaying the right answer in a big string without actually computing it will be treated as cheating during the peer-evaluation.

Be sure to provide a tests suite to prove that your function works as intended during peer-evaluation ("tests suite" might be a little bit of an over-statement as well).



# Chapter XV

### Submission and peer-evaluation

Turn in your assignment in your Git repository as usual. Only the work inside your repository will be evaluated during the defense. Don't hesitate to double check the names of your folders and files to ensure they are correct.



The evaluation process will happen on the computer of the evaluated group.