Assignment - Part 1

Background

For this assignment, you are supposed to implement a program that :

1. draws the "outline" of a rectangle (with dimensions to be entered by user), compute and print info like perimeter & area of the rectangle specified by user
2. prints (formatted) details about a number entered by the user

Note #1 : please refer to section on Sample Output(s), which will contain examples of what kind of details to be computed and/or printed regarding the number, as well as how it looks like when a rectangle outline is being displayed

In addition, your program should allow user to configure various options for the main functionalities mentioned above.

For drawing the rectangle, your program should allow the user to configure the following :

- toggle marking of rectangle center (default is "off")
- toggle marking of rectangle corner (default is "off")
- change character for printing of rectangle center (default is 'X' character)
- change character for printing of rectangle corner (default is 'c' character)
- change character for printing of rectangle corner (default is '#' character)

For formatted printing of the number, your program should allow the user to configure the following :

- adjust the width of field 1 (default is 15 spacing allocated)
- adjust the width of field 2 (default is 15 spacing allocated)
- adjust the width of field 3 (default is 30 spacing allocated)
- adjust the width of field 4 (default is 15 spacing allocated)
- adjust the floating point number precision (default is up to 8 decimal places)

Note #2 : please refer to section on Sample Output(s), which will contain an illustration of the relationship between the widths of fields 1-4, and how they affect the alignment and printing of various values for a SINGLE line

Program Menu(s)

Upon program startup, your program should print a welcome message, followed by the main menu, before prompting user to enter his choice.

```
-------------------------------------------------
- Welcome to My Assn P1 Program! -
-------------------------------------------------
- Student Number : < your student number >
- Student Name   : < your name >
-------------------------------------------------


-------------------------------------------------

1) Configure: Draw Rectangle Options
2) Configure: Print Number Info Options
3) Draw a Rectangle
4) Print Info on a number
5) Quit

-------------------------------------------------

Please enter your choice (1 - 5) : 1
```

Welcome Message
Only need to print once,
when program just started

Main Menu
Print as many times as necessary,
until user enter 5 to quit program

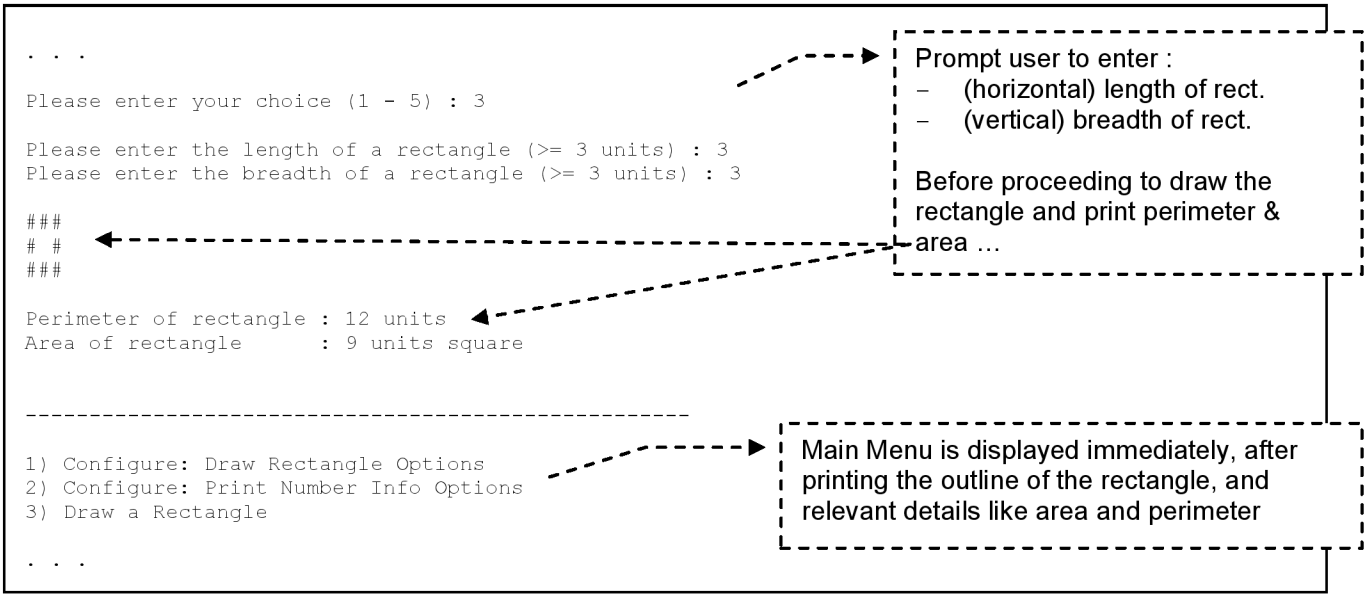
If user enters '2',
then display this
sub-menu …

```
-------------------------------------------------
---- Configure Draw Rectangle Options Sub Menu -----
-------------------------------------------------

0) Back to Main Menu
1) Toggle marking of rectangle center  (currently : 'off')
2) Toggle marking of rectangle corner  (currently : 'off')
3) Change char for rectangle center    (current   : 'X')
4) Change char for rectangle corner    (current   : 'c')
5) Change char for rectangle perimeter (current   : '#')

-------------------------------------------------

Please enter your choice (0 - 5) :
```

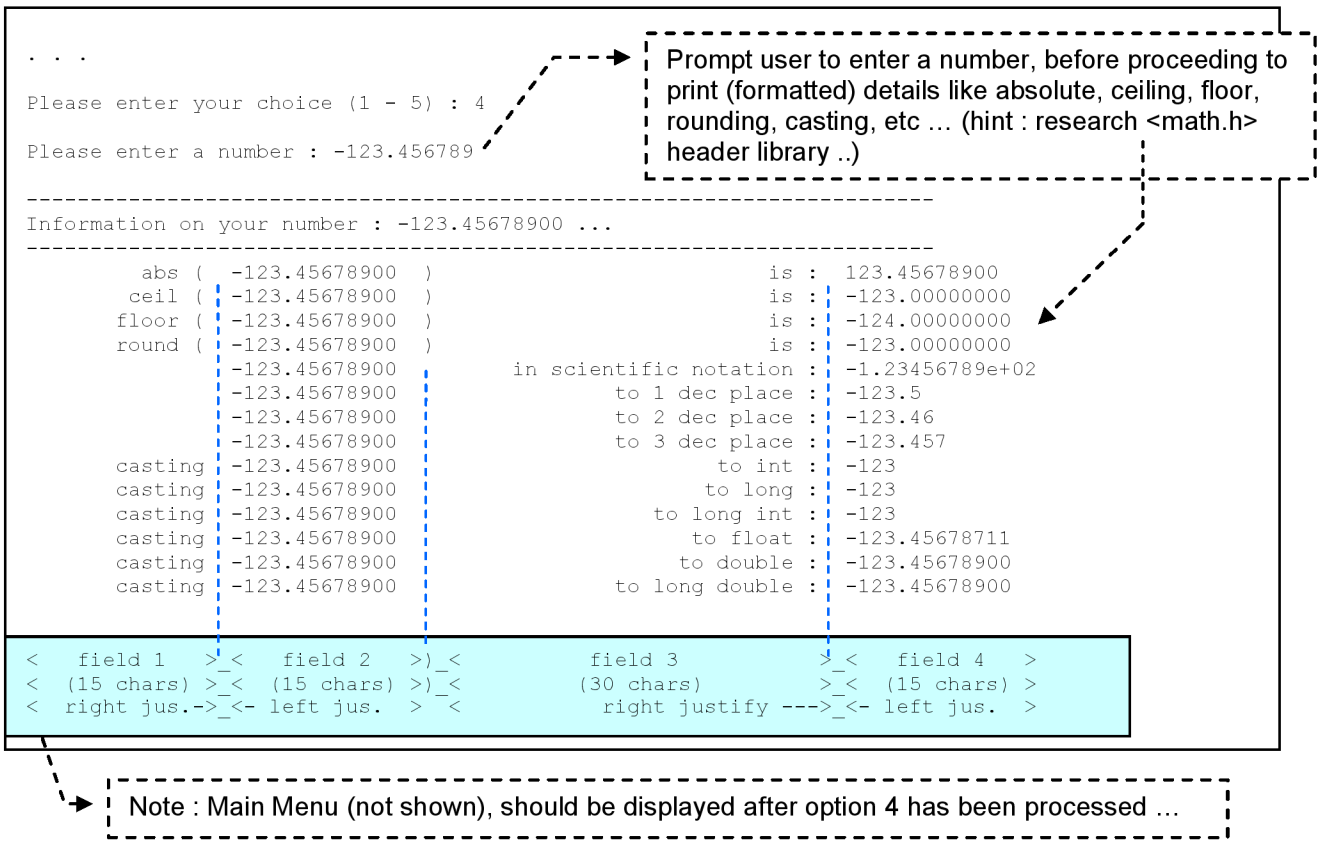
```
-------------------------------------------------
----- Configure Print Number Options Sub Menu ------
-------------------------------------------------

0) Back to Main Menu
1) Adjust width of field 1                (current : 15 spacing allocated)
2) Adjust width of field 2                (current : 15 spacing allocated)
3) Adjust width of field 3                (current : 30 spacing allocated)
4) Adjust width of field 4                (current : 15 spacing allocated)
5) Adjust floating point number precision (current : 8 decimal place)

-------------------------------------------------

Please enter your choice (0 - 5) :
```

Sample Output(s)

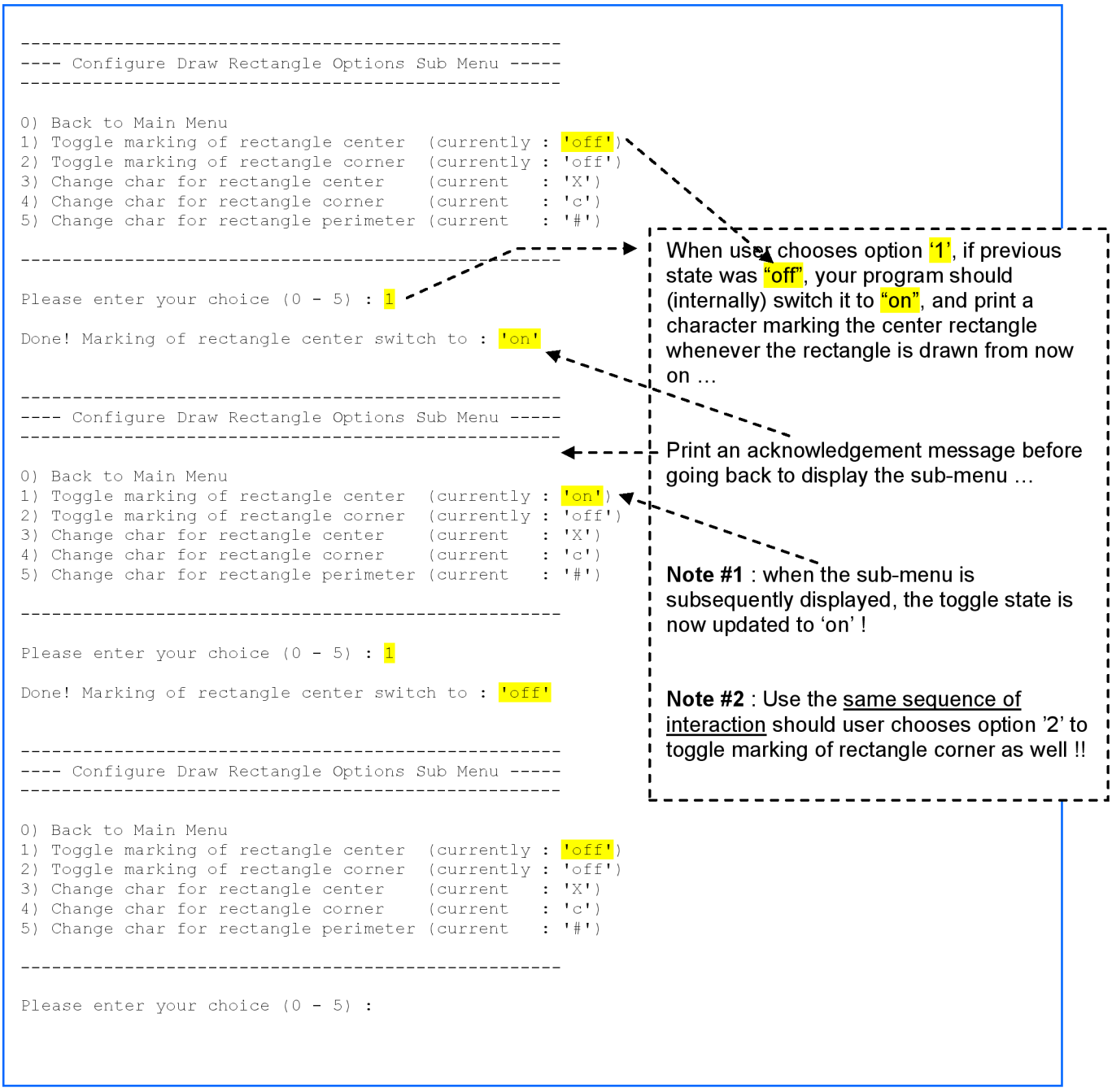
From main menu, if the user chooses '3', please implement the following interaction sequence(s) below prior to drawing the rectangle.



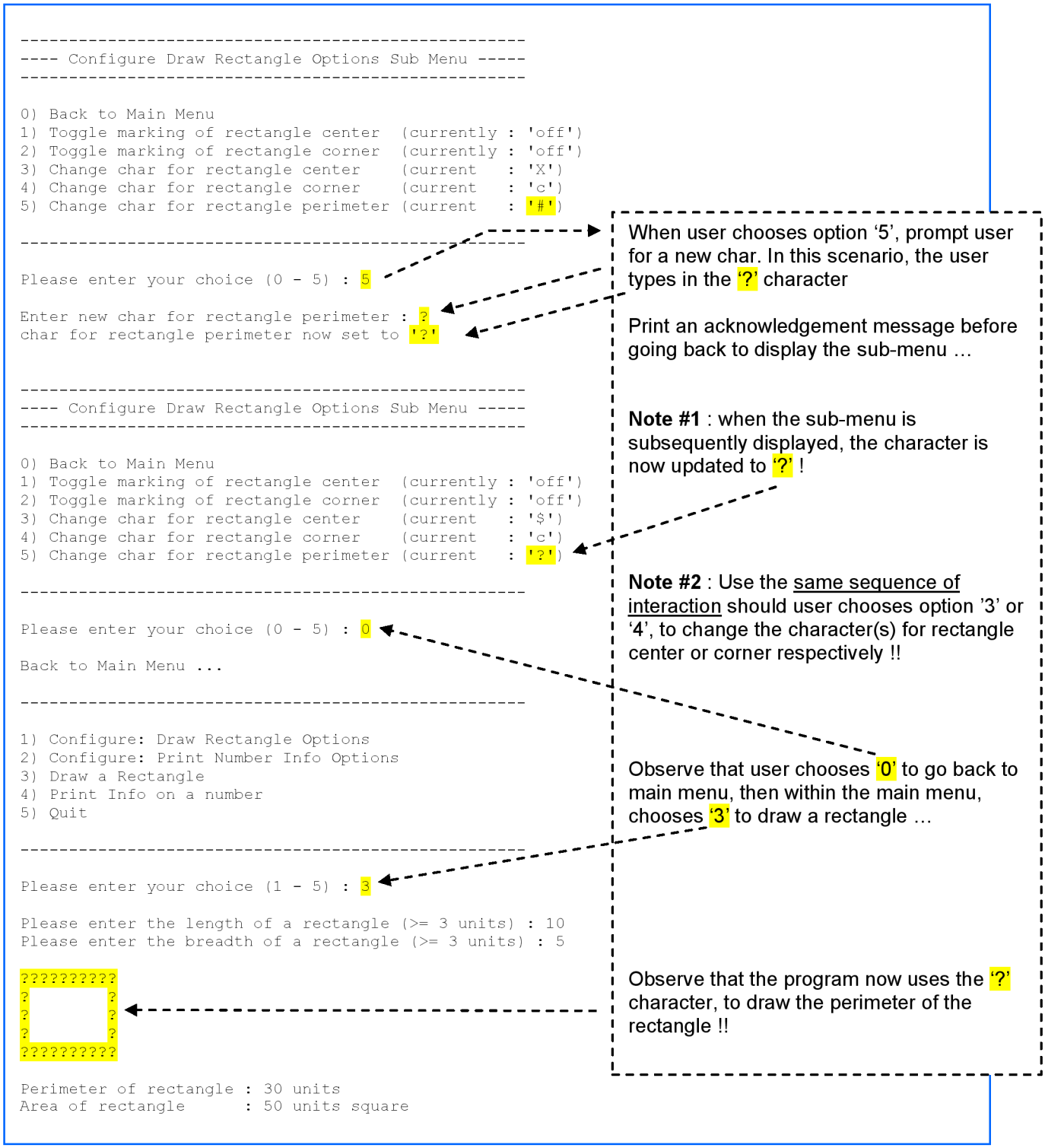
From main menu, if the user chooses '4', please implement the following interaction sequence(s) below prior to printing details on the user entered number.



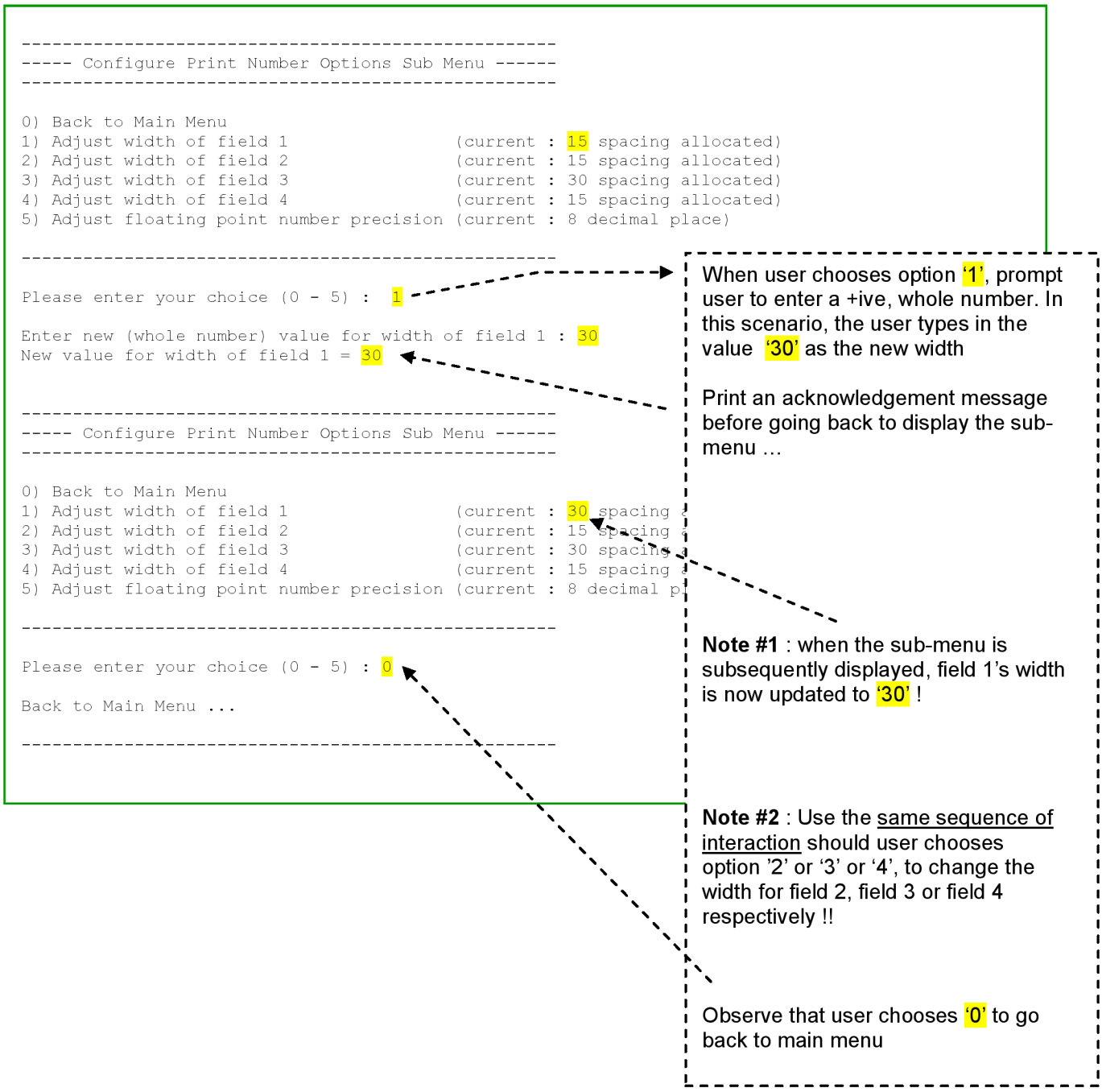
For "Configure Draw Rectangle Options Sub Menu", if user chooses to toggle the marking of rectangle center, please implement the following interaction sequence(s) as shown :



For "Configure Draw Rectangle Options Sub Menu", if user chooses to change char for rectangle perimeter, please implement the following interaction sequence(s) as shown :



For "Configure Print Number Options Sub Menu", if user chooses to adjust width of field 1, please implement the following interaction sequence(s) as shown :



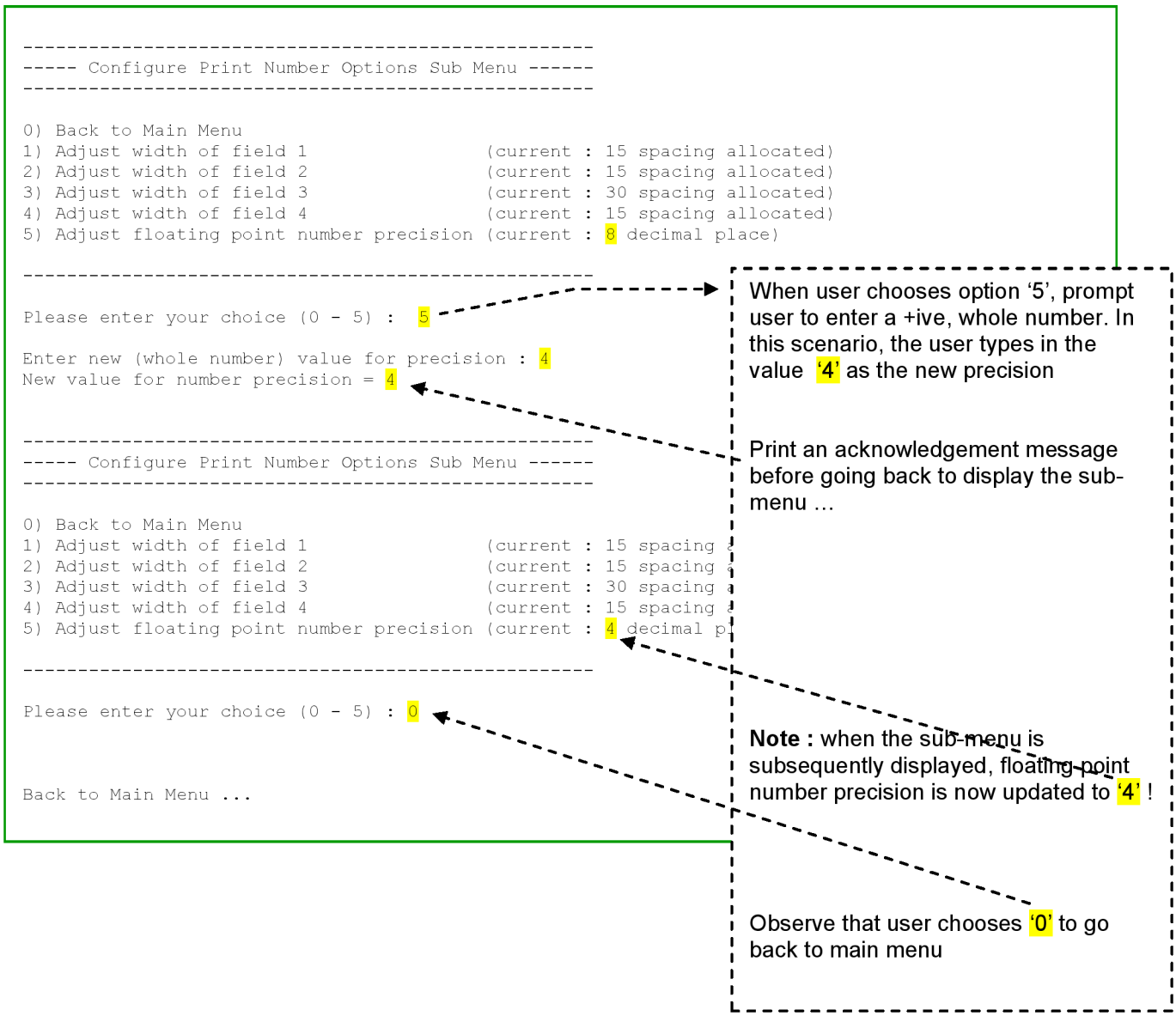
(con't)
For "Configure Print Number Options Sub Menu", if user chooses to adjust width of field 1, please implement the following interaction sequence(s) as shown :

```
Back to Main Menu ...

-------------------------------------------------

1) Configure: Draw Rectangle Options
2) Configure: Print Number Info Options
3) Draw a Rectangle
4) Print Info on a number
5) Quit

-------------------------------------------------

Please enter your choice (1 - 5) : 4

Please enter a number : -123.456789
-------------------------------------------------------------------
Information on your number : -123.45678900 ...
-------------------------------------------------------------------
                       abs ( -123.45678900  )                    is :  123.45678900
                      ceil ( -123.45678900  )                    is :  -123.00000000
                     floor ( -123.45678900  )                    is :  -124.00000000
                     round ( -123.45678900  )                    is :  -123.00000000
                           -123.45678900          in scientific notation :  -1.23456789e+02
                           -123.45678900               to 1 dec place :  -123.5
                           -123.45678900               to 2 dec place :  -123.46
                           -123.45678900               to 3 dec place :  -123.457
                     casting -123.45678900                    to int :  -123
                     casting -123.45678900                   to long :  -123
                     casting -123.45678900               to long int :  -123
                     casting -123.45678900                  to float :  -123.45678711
                     casting -123.45678900                 to double :  -123.45678900
                     casting -123.45678900              to long double :  -123.45678900

-------------------------------------------------
<          field 1          >_<   field 2   >)_<          field 3          >_<   field 4   >
<        (30 chars)         >_<  (15 chars) >)_<        (30 chars)         >_<  (15 chars) >
<            right jus.  --->_<- left jus.  > <          right justify --->_<- left jus.  >

-------------------------------------------------

1) Configure: Draw Rectangle Options
2) Configure: Print Number Info Options
3) Draw a Rectangle
4) Print Info on a number
5) Quit

-------------------------------------------------

Please enter your choice (1 - 5)
```

From main menu, user chooses '4' to print into on a number …

From the 1st line " .. `abs ( -123.45` .. ", we observe that the program now uses the new value '30' for the width of field 1! So now, there appears to be a much "wider gap" between the left edge of the terminal screen, and the 1st column of content " .. `abs ( -123.45` .. " which *applies to all the following lines as well* !!

For "Configure Print Number Options Sub Menu", if user chooses to adjust floating point number precision, please implement the following interaction sequence(s) as shown :



(con't)
For "Configure Print Number Options Sub Menu", if user chooses to adjust floating point number precision, please implement the following interaction sequence(s) as shown :

```
Back to Main Menu ...

-------------------------------------------------

1) Configure: Draw Rectangle Options
2) Configure: Print Number Info Options
3) Draw a Rectangle
4) Print Info on a number
5) Quit

-------------------------------------------------

Please enter your choice (1 - 5) : 4


Please enter a number : -123.456789
-----------------------------------------------------------------------
Information on your number : -123.4568 ...
-----------------------------------------------------------------------
         abs (  -123.4568      )                          is :  123.4568
        ceil (  -123.4568      )                          is :  -123.0000
       floor (  -123.4568      )                          is :  -124.0000
       round (  -123.4568      )                          is :  -123.0000
                -123.4568                in scientific notation :  -1.2346e+02
                -123.4568                       to 1 dec place :  -123.5
                -123.4568                       to 2 dec place :  -123.46
                -123.4568                       to 3 dec place :  -123.457
       casting  -123.4568                              to int :  -123
       casting  -123.4568                             to long :  -123
       casting  -123.4568                        to long int :  -123
       casting  -123.4568                           to float :  -123.4568
       casting  -123.4568                          to double :  -123.4568
       casting  -123.4568                       to long double :  -123.4568


-------------------------------------------------

1) Configure: Draw Rectangle Options
2) Configure: Print Number Info Options
3) Draw a Rectangle
4) Print Info on a number
5) Quit

-------------------------------------------------

Please enter your choice (1 - 5) :
```

From main menu, user chooses '4' to print into on a number …

For certain lines (marked by **green background rounded rectangle**), note that the precision has been changed to 4 decimal places accordingly!

Below are sample “permutations” of (odd & even) length and breadth values, and how it affects the drawing and marking of rectangle center + corners.

Assume that the “Configure: Draw Rectangle Options” is ALREADY SETUP as shown below :

```
. . .

--------------------------------------------------
---- Configure Draw Rectangle Options Sub Menu -----
--------------------------------------------------

0) Back to Main Menu
1) Toggle marking of rectangle center  (currently : 'on')
2) Toggle marking of rectangle corner  (currently : 'on')
3) Change char for rectangle center    (current   : '+')
4) Change char for rectangle corner    (current   : 'k')
5) Change char for rectangle perimeter (current   : '#')

--------------------------------------------------
. . .
```

```
--------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 9
Please enter the breadth of a rectangle (>= 3 units) : 7

#########
#k      k#
#        #
#    +   #
#        #
#k      k#
#########

Perimeter of rectangle : 32 units
Area of rectangle      : 63 units square

. . .
```

Example of Draw Rectangle, with length = odd units, breadth = odd units …

Example of Draw Rectangle, with length = even units, breadth = even units …

```
--------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 12
Please enter the breadth of a rectangle (>= 3 units) : 6

############
#k        k#
#     ++   #
#     ++   #
#k        k#
############

Perimeter of rectangle : 36 units
Area of rectangle      : 72 units square

. . .
```

```
-------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 14
Please enter the breadth of a rectangle (>= 3 units) : 7

###############
#k            k#
#              #
#      ++      #
#              #
#k            k#
###############

Perimeter of rectangle : 42 units
Area of rectangle      : 98 units square
. . .
```

Example of Draw Rectangle, with length = even units, breadth = odd units …

Example of Draw Rectangle, with length = odd units, breadth = even units …

```
-------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 13
Please enter the breadth of a rectangle (>= 3 units) : 6

#############
#k          k#
#      +     #
#      +     #
#k          k#
#############

Perimeter of rectangle : 38 units
Area of rectangle      : 78 units square

. . .
```

Resources

Within your "… Pkg.zip" file, please locate and review the contents from the following files

- MyMenu.h
- MyMenu.c
- StuAssnP1Main.c

The file "StuAssnP1Main.c" contains the main() function, which represents the main instructions that will be executed by the (Ubuntu) OS when the binary executable is being run.

It contains a "wealth" of information like :

1) sample command to type in the terminal to compile the files into a binary executable "AssnPart1.run"
2) sample command to type in the terminal, to run the generated executable file "AssnPart1.run" program
3) recommended C header libraries to include
4) #include "MyMenu.h", (your very first header, where you can place all other menu related function prototypes, there is even 1 example done for you => check out the contents in "MyMenu.h" !)
5) Examples of pre-processor macro #define, and how to declare constants
6) Examples of global variables, "in-house" function prototypes
7) Sample code in main(), and it is already working (i.e. can compile and run already!). Of course, majority of the functionalities still requires you to implement, but the "skeletal framework" is already implemented as an example for you!

The file "MyMenu.h" contains the "framework" as an example for all other additional *.h header files that you may be implementing for this, or any other assessments in future. You will find that there is only 1 "lonely" function prototype, but you can always add more!

The file "MyMenu.c" contains a "simpler framework" as an example of how, the source code for all the function prototypes (declared in the *.h header files) can be implemented in future, for all other assessments as well!

Finally, you are free to design additional "helper functions", place them in appropriate header (*.h) and source (*.c) files, and invoke them from your main(). (For example, you may design a group of helper functions that specifically deals with drawing of rectangle, and place them in a "DrawRect.h" and "DrawRect.c" files!)

Deliverables

In terms of how to organized your deliverable files, please refer to the main Assignment document "RSE1201_Assignment ..", APPENDIX E-2

Below describes the "typical files" that should be included in your submission.

Place within "inc" sub-folder …

- Menu.h
- ... any other header (*.h) files you implement

Place within "src" sub-folder …

- AssnPart1.c // file that contains your main() function
- Menu.c
- … any other source (*.c) files you implement

Place within "obj" sub-folder …

- Menu.o // hint : generated using " gcc –c Menu.c … " – research on this!
- … any other object (*.o) files where relevant

Place within the "root" folder …

- AssnPart1.run // your generated program executable!
- acknowledgement.txt /* declare the LEGITIMATE sources in which part of your work (< 30%) is derived from */

- readme.txt // compilation command to type, to generate your *.run executable
  OR
  makefile /* exploit make programming instructions to conveniently compile your program! */

Additional Considerations …

A) If you analyzed all the requirements and information from the above sections, you will quickly realize that it is **impossible**, to specify all possible usage scenarios, permutations of interactions, covering a wide variety of situations from invalid input, invalid values, to "subtler" issues :

(i) Should there be a limitation (i.e. minimum / maximum) values that user can type for the rectangle's length and breadth?

(ii) What are the minimum values for length and breadth, below which I cannot reasonably "mark" the rectangle's center or corner?

(iii) If both length and breath are odd number, am I able to mark the rectangle's center using a single char (e.g. 'X') ?

(iv) Under what combinations of values for length and breadth, will I be required to use >1 char to mark the center of the rectangle?

(v) What is the range of values that my program can accept, or I can allow user to type ANY number, of ANY PRECISION, and it won't have any impact on my formatting?

(vi) What about the widths for fields 1 to 4, are there certain min / max values?

(vii) Etc.

B) These are "real life" issues that you may encounter as you develop your programs in future, and you will find that there are no easy / quick answers. Of course, this being an Academic Assessment, there has to be clarity on some of the issues mentioned above.

For (i) – (ii), there are some hints as the min. values just to DRAW the perimeter, and to mark the corners of the rectangle. (hint : study the code in "StuAssnP1Main.c" again!).

For the purposes of this assignment, the :
max (horizontal) length user can specify for rectangle should be <= 100
max (vertical) breadth user can specify for rectangle should be <= 20

For (iii) – (iv), please refer to Appendix A – Other Sample Program Interactions for clues

For (v), the hint is to research on the range of data type "long double", declare variables and use it to store the number entered by user. Also, limit the precision user can type to <= 15

For (vi), the default values mentioned for each of the fields 1 to 4 serves as a reference for the "middle value". Do not allow user to enter values which are :
< 50% of each of the field's initial default values
> 100% of each of the field's initial default values

APPENDIX A

(Other Sample Program Interaction(s))

```
--------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 3
Please enter the breadth of a rectangle (>= 3 units) : 3

###
# #
###

Perimeter of rectangle : 12 units
Area of rectangle      : 9 units square
. . .
```

Draw Rectangle, the smallest possible dimensions that could still print the center, (but not the 4 corners, even if switched to 'on' !) …

Draw Rectangle, the smallest possible dimensions that could still print the 4 corners …

```
--------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 5
Please enter the breadth of a rectangle (>= 3 units) : 5

#####
#k k#
#   #
#k k#
#####

Perimeter of rectangle : 20 units
Area of rectangle      : 25 units square
. . .
```

```
--------------------------------------------------

Please enter your choice (1 - 5) : 3

Please enter the length of a rectangle (>= 3 units) : 1
Please enter the breadth of a rectangle (>= 3 units) : 1

#

Perimeter of rectangle : 4 units
Area of rectangle      : 1 units square. . .
```

Draw Rectangle, oh no, we are going to generate a singularity!