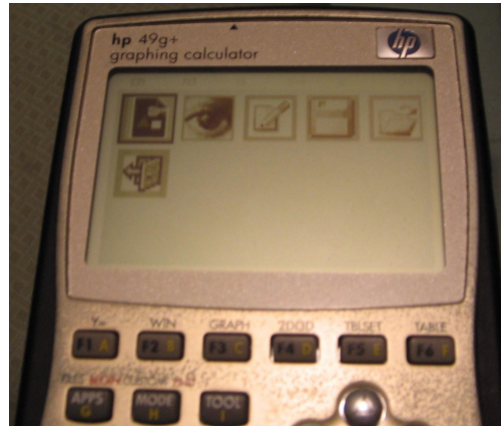


SECC+ V1.21

Edwin Córdoba

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1 INTRODUCTION.

Secc+ is a program for calculating geometric properties (moment of inertia, centroid, area, etc.) of any plane figure which can be defined by polygons, circles, rectangles and circular sectors. It is programmed completely in C, using HP-GCC.

2 CREDITS.

I thank a very special people who have worked on the project HP-GCC (Ingo Blank, Claudio Lapilli, Benjamin Maurin, Al Borowski and Chris Smith.), For making it possible to make C programs.

3 INSTALLATION.

The program does not require installation, just have to copy the file *SECCION.HP* to the root of port 2 or port 3 (SD card) and copy the directory *SECC.DIR* to HOME. You must have installed the ArmToolBox Version 3.12 or higher, which can be downloaded at the following link: <http://www.hpcalc.org/details.php?id=6090>

4 OPERATION

The program is divided into two menus described below:

4.1 Main Menu



4.1.1 Enter data of new figures.



Allows entry of new figures, selecting this icon, it displays a secondary menu for the entry of figures.

4.1.2 See drawing and calculated properties.





Selecting this icon displays a diagram of the section and the calculated properties. The description of the properties are specified below.

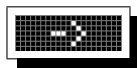
4.1.3 modify figures.





After the figures have been created, you can edit them by selecting this icon, it will show the figures to be modified individually, the description of the menus are:



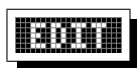
Switch to the previous figure, you get the same results if you press the keys  or .



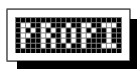
Switch to the following figure, you get the same results if you press the keys  or .



Eliminates the figure that is currently selected.



Edit the figure that is currently selected.



Displays the properties of the figure that is currently selected.



Ends the editing operation.

4.1.4 Save data.



Saves data into the memory SD¹, in a folder called "SEC", if this folder does not exist, the program creates it. The format and data is stored is described below.

4.1.5 Opening a saved document.



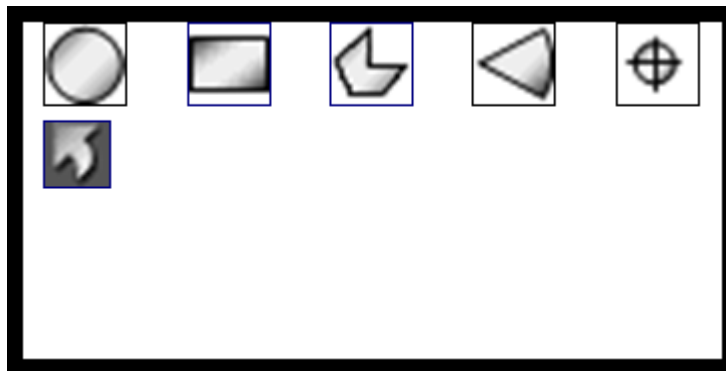
Open the data in a section that has been stored on the SD², under the folder SEC.

4.1.6 Exit the application.



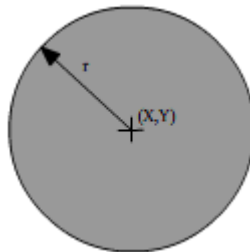
Exits the application and does not return any value to the stack.

4.2 Secondary Menu.



¹This option is possible if you have inserted an SD card.

²This option is possible if you have inserted an SD card.

4.2.1 Enter a circle.

Input data:

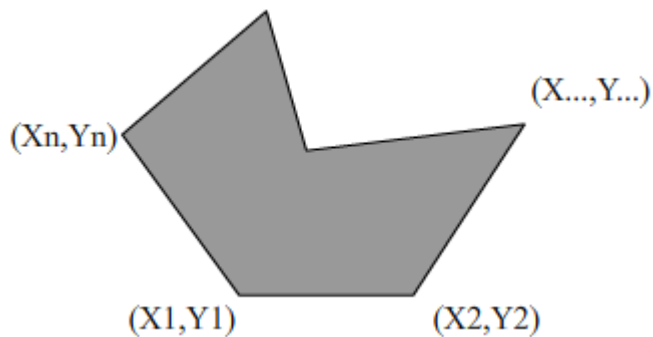
- X: X coordinate of the center.
- Y: Y coordinate of the center.
- r: Radius.

4.2.2 Enter a rectangle.

Input data:

- X1: X-coordinate low left point.
- Y1: Y-coordinate low left point.
- X2: X-coordinate upper left point.
- Y2: Y-coordinate upper left point.

4.2.3 Enter an irregular polygon.

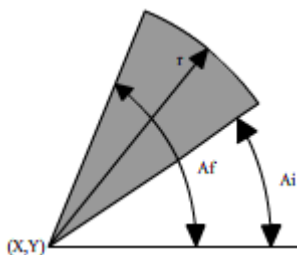


Input data:

- X: X-coordinate.
- Y: Y-coordinate.

The data is entered and the program then stops receiving data of coordinates in the time it enters the cell is empty values.

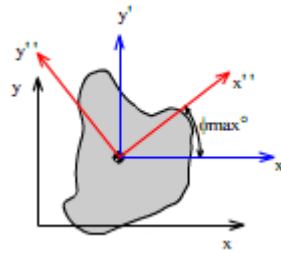
4.2.4 Enter a Circular Sector.



Input data:

- X: X coordinate of the center.
- Y: Y coordinate of the center.
- r: Radius.
- Ai: Initial angle.
- Af: Final angle.

Figure 1: Graphic axes of the section



4.2.5 Enter properties of a figure.



Input data:

- A: Area.
- X: Centroid X.
- Y: Centroid Y.
- I_{xxc}: Moment of inertia X centroidal.
- I_{yyc}: Moment of inertia Y centroidal.
- I_{xy}: Product of inertia XY centroidal.

4.2.6 Return to the main menu.



It is returned to the main menu allowing access to other functions of the program.

5 Results.

The program returned as results described in Table 1.

Table 1: Description of the properties.

Area	Area of the figure.
X_c	X Centroid of the figure.
Y_c	Y Centroid of the figure.
I_{xxc}	Moment of inertia about the axis X' centroidal.
I_{yyc}	Moment of inertia about the axis Y' centroidal.
I_{xyc}	Product of inertia about the axis X', Y' centroidal.
I_{xx}	Moment of inertia about the axis X.
I_{yy}	Moment of inertia about the axis Y.
I_{xy}	Product of inertia about the axis X, Y.
I_{max}	Maximum moment of inertia using the centroidal coordinates, axis X".
I_{min}	Maximum moment of inertia using the centroidal coordinates, axis Y".
θ_{max}	Angle where the maximum moment of the centroidal axes.

6 File format.

Saved documents use a label format as shown below:

```
<?Version="1.21"?>
<?Application="Secc+"?>
<Figures>
  <Circle>
    <Radius>%f</Radius>
    <Center.X>%f</Center.X>
    <Center.Y>%f</Center.Y>
    <Signe>%c</Signe>
  </Circle>
  <Rectangle>
    <UpRight.X>%f</UpRight.X>
    <UpRight.Y>%f</UpRight.Y>
    <DownLeft.X>%f</DownLeft.X>
    <DownLeft.Y>%f</DownLeft.Y>
    <Signe>%c</Signe>
  </Rectangle>
  <Sector>
    <Radius>%f</Radius>
    <Center.X>%f</Center.X>
```

```

        <Center.Y>%f</Center.Y>
        <Ang.Inicial>%f</Ang.Inicial>
        <Ang.Final>%f</Ang.Final>
        <Signe>%c</Signe>
    </Sector>
    <Polygon>
        <Point.X>%f</Point.X>
        <Point.Y>%f</Point.Y>
        ...
        <Signe>%c</Signe>
    </Polygon>
    <Propierties>
        <Area>%f<Area>
        <Center.X>%f</Center.X>
        <Center.Y>%f</Center.Y>
        <Ixxc>%f<Ixxc>
        <Iyyc>%f<Iyyc>
        <Ixyc>%f<Ixyc>
        <Signe>%c</Signe>
    </Propierties>
</Figures>

```

7 Example.

Find the centroid of the section in Figure 2.

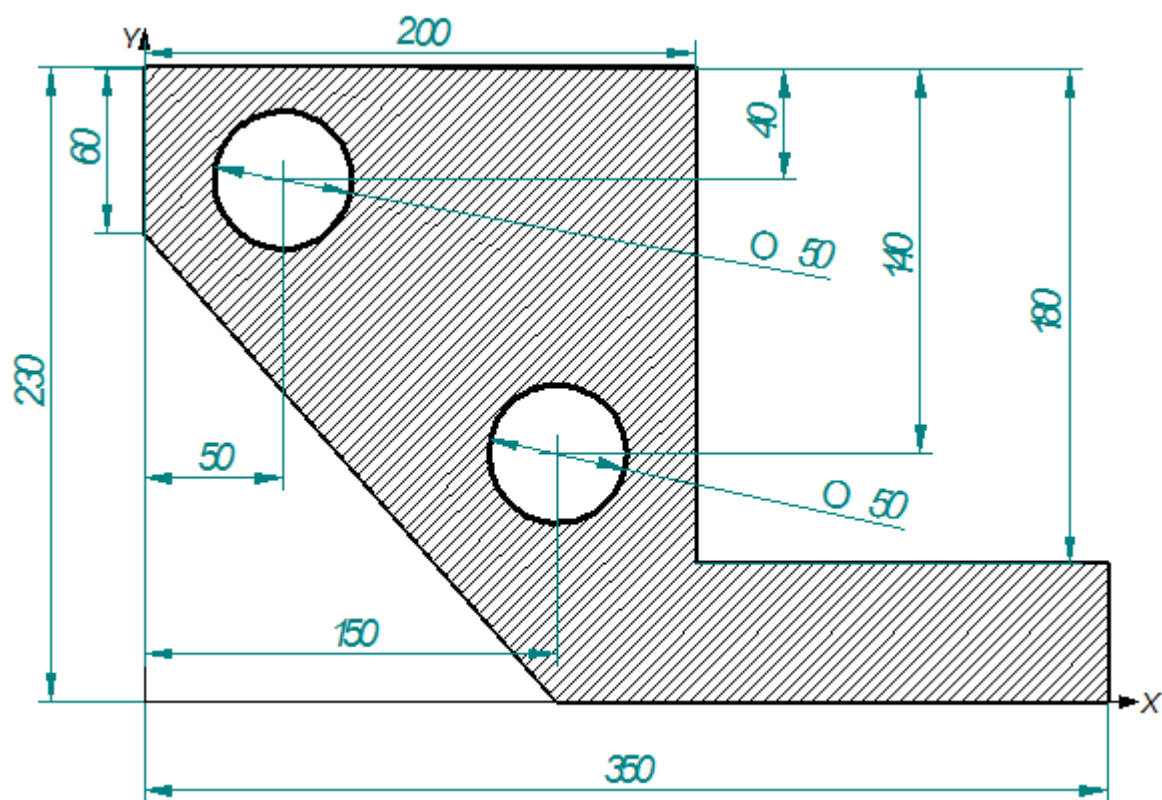
Identify existing figures section.

Polygon (Positive):

Coordinates

- (150,0)
- (350,0)
- (350,50)
- (200,50)

Figure 2: Section of the example.



- (200,230)
- (0,230)
- (0,170)

Circle (Negative):

- Center: (50,190)
- Radius: 25

Circle (Negative):

- Center: (150,90)
- Radius: 25

If you save this section, the generated file is:

```
<?Version="1.21"?>
<?Application="Secc+"?>
<Figures>
  <Polygon>
    <Point.X>150.000000</Point.X>
    <Point.Y>0.000000</Point.Y>
    <Point.X>350.000000</Point.X>
    <Point.Y>0.000000</Point.Y>
    <Point.X>350.000000</Point.X>
    <Point.Y>40.000000</Point.Y>
    <Point.X>200.000000</Point.X>
    <Point.Y>40.000000</Point.Y>
    <Point.X>200.000000</Point.X>
    <Point.Y>230.000000</Point.Y>
    <Point.X>0.000000</Point.X>
    <Point.Y>230.000000</Point.Y>
    <Point.X>0.000000</Point.X>
    <Point.Y>170.000000</Point.Y>
    <Signe>+</Signe>
```

```

    </Polygon>
    <Circle>
        <Radious>25.000000</Radious>
        <Center.X>50.000000</Center.X>
        <Center.Y>190.000000</Center.Y>
        <Signe>-</Signe>
    </Circle>
    <Circle>
        <Radious>25.000000</Radious>
        <Center.X>150.000000</Center.X>
        <Center.Y>90.000000</Center.Y>
        <Signe>-</Signe>
    </Circle>
</Figures>

```

The result of the centroid is calculated as follows:

$$X_{\{c\}} = 152.95602$$

$$Y_{\{c\}} = 114.200913$$

8 Changes

8.1 Version 1.21

- Bug Fix in the calculation of product of inertia in circular sections.

9 Contact

edwin.cordoba@gmail.com