

```

#!/bin/sh
# the next line restarts using wish \
exec wish "$0" "$@"

# root is the parent window for this user interface

package require Tk

wm title . ""
tk_setPalette cyan3

# Define some variables
# this treats "." as a special case
set root "."

set base ""
set maxX 500
set maxY 500
set width 0
set height 0
set midX 0
set midY 0

set rmin -5.0
set rmax 5.0
set ymax 5.
set ymin -5.
set cc 0.2
set np 300
set angle 137.5
set bimg 1

set COLORS { snow {ghost white} {white smoke} gainsboro {floral white}
{old lace} linen {antique white} {papaya whip} {blanched almond}
bisque {peach puff} {navajo white} moccasin cornsilk ivory
{lemon chiffon} seashell honeydew {mint cream} azure {alice blue}
lavender {lavender blush} {misty rose} white black {dark slate gray}
{dim gray} {slate gray} {light slate gray} gray {light grey}
{midnight blue} navy {cornflower blue} {dark slate blue} {slate blue}
{medium slate blue} {light slate blue} {medium blue} {royal blue}
blue {dodger blue} {deep sky blue} {sky blue} {light sky blue}
{steel blue} {light steel blue} {light blue} {powder blue}
{pale turquoise} {dark turquoise} {medium turquoise} turquoise
cyan {light cyan} {cadet blue} {medium aquamarine} aquamarine
{dark green} {dark olive green} {dark sea green} {sea green}
{medium sea green} {light sea green} {pale green} {spring green}
{lawn green} green chartreuse {medium spring green} {green yellow}
{lime green} {yellow green} {forest green} {olive drab} {dark khaki}
khaki {pale goldenrod} {light goldenrod yellow} {light yellow} yellow
gold {light goldenrod} goldenrod {dark goldenrod} {rosy brown}
{indian red} {saddle brown} sienna peru burlywood beige wheat
{sandy brown} tan chocolate firebrick brown {dark salmon} salmon
{light salmon} orange {dark orange} coral {light coral} tomato
{orange red} red {hot pink} {deep pink} pink {light pink}
{pale violet red} maroon {medium violet red} {violet red}
magenta violet plum orchid {medium orchid} {dark orchid} {dark violet}
{blue violet} purple {medium purple} thistle snow2 snow3
snow4 seashell2 seashell3 seashell4 AntiqueWhite1 AntiqueWhite2
AntiqueWhite3 AntiqueWhite4 bisque2 bisque3 bisque4 PeachPuff2
PeachPuff3 PeachPuff4 NavajoWhite2 NavajoWhite3 NavajoWhite4
LemonChiffon2 LemonChiffon3 LemonChiffon4 cornsilk2 cornsilk3

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cornsilk4 ivory2 ivory3 ivory4 honeydew2 honeydew3 honeydew4
LavenderBlush2 LavenderBlush3 LavenderBlush4 MistyRose2 MistyRose3
MistyRose4 azure2 azure3 azure4 SlateBlue1 SlateBlue2 SlateBlue3
SlateBlue4 RoyalBlue1 RoyalBlue2 RoyalBlue3 RoyalBlue4 blue2 blue4
DodgerBlue2 DodgerBlue3 DodgerBlue4 SteelBlue1 SteelBlue2
SteelBlue3 SteelBlue4 DeepSkyBlue2 DeepSkyBlue3 DeepSkyBlue4
SkyBlue1 SkyBlue2 SkyBlue3 SkyBlue4 LightSkyBlue1 LightSkyBlue2
LightSkyBlue3 LightSkyBlue4 SlateGray1 SlateGray2 SlateGray3
SlateGray4 LightSteelBlue1 LightSteelBlue2 LightSteelBlue3
LightSteelBlue4 LightBlue1 LightBlue2 LightBlue3 LightBlue4
LightCyan2 LightCyan3 LightCyan4 PaleTurquoise1 PaleTurquoise2
PaleTurquoise3 PaleTurquoise4 CadetBlue1 CadetBlue2 CadetBlue3
CadetBlue4 turquoise1 turquoise2 turquoise3 turquoise4 cyan2 cyan3
cyan4 DarkSlateGray1 DarkSlateGray2 DarkSlateGray3 DarkSlateGray4
aquamarine2 aquamarine4 DarkSeaGreen1 DarkSeaGreen2 DarkSeaGreen3
DarkSeaGreen4 SeaGreen1 SeaGreen2 SeaGreen3 PaleGreen1 PaleGreen2
PaleGreen3 PaleGreen4 SpringGreen2 SpringGreen3 SpringGreen4
green2 green3 green4 chartreuse2 chartreuse3 chartreuse4
OliveDrab1 OliveDrab2 OliveDrab4 DarkOliveGreen1 DarkOliveGreen2
DarkOliveGreen3 DarkOliveGreen4 khaki1 khaki2 khaki3 khaki4
LightGoldenrod1 LightGoldenrod2 LightGoldenrod3 LightGoldenrod4
LightYellow2 LightYellow3 LightYellow4 yellow2 yellow3 yellow4
gold2 gold3 gold4 goldenrod1 goldenrod2 goldenrod3 goldenrod4
DarkGoldenrod1 DarkGoldenrod2 DarkGoldenrod3 DarkGoldenrod4
RosyBrown1 RosyBrown2 RosyBrown3 RosyBrown4 IndianRed1 IndianRed2
IndianRed3 IndianRed4 sienna1 sienna2 sienna3 sienna4 burlywood1
burlywood2 burlywood3 burlywood4 wheat1 wheat2 wheat3 wheat4 tan1
tan2 tan4 chocolate1 chocolate2 chocolate3 firebrick1 firebrick2
firebrick3 firebrick4 brown1 brown2 brown3 brown4 salmon1 salmon2
salmon3 salmon4 LightSalmon2 LightSalmon3 LightSalmon4 orange2
orange3 orange4 DarkOrange1 DarkOrange2 DarkOrange3 DarkOrange4
coral1 coral2 coral3 coral4 tomato2 tomato3 tomato4 OrangeRed2
OrangeRed3 OrangeRed4 red2 red3 red4 DeepPink2 DeepPink3 DeepPink4
HotPink1 HotPink2 HotPink3 HotPink4 pink1 pink2 pink3 pink4
LightPink1 LightPink2 LightPink3 LightPink4 PaleVioletRed1
PaleVioletRed2 PaleVioletRed3 PaleVioletRed4 maroon1 maroon2
maroon3 maroon4 VioletRed1 VioletRed2 VioletRed3 VioletRed4
magenta2 magenta3 magenta4 orchid1 orchid2 orchid3 orchid4 plum1
plum2 plum3 plum4 MediumOrchid1 MediumOrchid2 MediumOrchid3
MediumOrchid4 DarkOrchid1 DarkOrchid2 DarkOrchid3 DarkOrchid4
purple1 purple2 purple3 purple4 MediumPurple1 MediumPurple2
MediumPurple3 MediumPurple4 thistle1 thistle2 thistle3 thistle4
gray1 gray2 gray3 gray4 gray5 gray6 gray7 gray8 gray9 gray10
gray11 gray12 gray13 gray14 gray15 gray16 gray17 gray18 gray19
gray20 gray21 gray22 gray23 gray24 gray25 gray26 gray27 gray28
gray29 gray30 gray31 gray32 gray33 gray34 gray35 gray36 gray37
gray38 gray39 gray40 gray42 gray43 gray44 gray45 gray46 gray47
gray48 gray49 gray50 gray51 gray52 gray53 gray54 gray55 gray56
gray57 gray58 gray59 gray60 gray61 gray62 gray63 gray64 gray65
gray66 gray67 gray68 gray69 gray70 gray71 gray72 gray73 gray74
gray75 gray76 gray77 gray78 gray79 gray80 gray81 gray82 gray83
gray84 gray85 gray86 gray87 gray88 gray89 gray90 gray91 gray92
gray93 gray94 gray95 gray97 gray98 gray99
}
set nCOLORS [llength $COLORS]
# Define global variables

global width height dcc img bimg COLORS nCOLORS crbow

```

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#####
##
## Procedures
#####
##

proc {SaveData} {} {

    # Get the value from the entries

    global cc np angle

    set file [tk_getSaveFile -parent .]
    set fp [open "$file" w]

    set rang [expr $angle/180.*3.1415926]

    for { set n 1 } { $n <= $np } { incr n 1 } {

        set x [expr ($cc*sqrt($n)*sin($rang*$n))]
        set y [expr ($cc*sqrt($n)*cos($rang*$n))]
        puts $fp "$x $y"

    }
    close $fp
}

#####
#####
# Some of the procedure are adapted from: http://wiki.tcl.tk/15073
#

proc ClrCanvas {w } {
    global dcc
    global rmin rmax width height ymax ymin midX midY

    $w delete "all"
    set dcc 0
    DrawAxis $w
}

proc DrawAxis {w} {

    global rmin rmax width height ymax ymin midX midY img bimg

    set midX [expr { $width / 2 }]
    set midY [expr { $height / 2 }]
    set incrX [expr { ($width-50) /10 }]
    set incrY [expr { $height /11 }]

    if {$bimg} {
        .cv create image 20 -38 -anchor nw -image $img
    }

    $w create line 0 $midY $width $midY -tags "Xaxis" -fill black -width 1
    $w create line $midX 0 $midX $height -tags "Yaxis" -fill black -width 1
    $w create text [expr $midX-20] 20 -text "Y"
    $w create text [ expr $width-20] [expr $midY+20] -text "X"
}

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proc PaintText {w Txt x y Col} {
    $w create text $x $y -text $Txt -fill $Col -anchor sw
}

proc DrawFn w {

    #
    # Plot the sunflower florets
    #

    global cc np angle COLORS nCOLORS crbow
    global rmin rmax width height ymax ymin midX midY

    ClrCanvas .cv

    set divy [expr ($ymax-$ymin)/$height ]
    set divx [expr ($rmax-$rmin)/$width]
    set asp_ratio 1.1
    set rang [expr $angle/180.*3.1415926]
    set ctype "red"

    DrawAxis $w
    for { set n 1 } { $n <= $np } { incr n 1 } {

        set x [expr $midX+ ($cc*sqrt($n)*sin($rang*$n))/divx]
        set y [expr $midY- ($cc*sqrt($n)*cos($rang*$n))/divy*$asp_ratio]
        if {$crbow} {
            set ctype [lindex $COLORS [expr $n%$nCOLORS+1]]
        }
    }

    PaintText .cv "*" $x $y $ctype
}

#####
#####
#
# Main with the setup up of the GUI
#####
#####

# Row 1
label $base.label#12 \
-background magenta -padx 64 -relief raised -text {Sunflower Calculator
(c) Danilo Roccatano 2002-2018}

# Row 2
label $base.label#1 -background green -relief groove -text "Parameter C:"

entry $base.cc -cursor {} -textvariable cc -bg white

label $base.label#3 -background green -relief groove -text "Number
florets:"

entry $base.np -textvariable np -bg white

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# row 3
label $base.langle -background cyan -relief groove -text "angle:" -bg cyan

entry $base.angle -cursor {} -textvariable angle -bg white

# Row 4

checkboxbutton $base.bimage -text "Show background Photo" -variable bimg -
command {DrawFn .cv}
checkboxbutton $base.rbow -text "Use palette" -variable crbow -command {DrawFn
.cv}

# row 5

set img [image create photo -file sunflower2.gif]

canvas $base.cv -bg white -height $maxY -width $maxX
if {$bimg} {
    .cv create image 20 -38 -anchor nw -image $img
}

# row 6

button $base.plot -text PLOT -command { DrawFn .cv }
button $base.b0 -text "Clear" -command { ClrCanvas .cv }
button $base.b1 -text "EXIT" -command { exit -1}
button $base.b2 -text "Save" -command { SaveData }

text $base.t -width 50 -height 5 -wrap word -bg gray90

#text $base.t -width 50 -height 5 -wrap word -yscrollcommand {$base.scroll
set} -bg gray90
.t insert end "Calculation of the florets arrangment in sunflowers using
the formulas:
x = C*sqrt(n)*sin(angle*n)
y = C*sqrt(n)*cos(angle*n)
with C the scaling constant, n the number of florets and angle the angular
parameter."

#
# Add contents to grid
#
# Row 1

grid $base.label#12 -in $root -row 1 -column 1 -columnspan 4 -sticky nesw
# Row 2
grid $base.label#1 -in $root -row 2 -column 1 -sticky nesw
grid $base.cc -in $root -row 2 -column 2 -sticky nesw
grid $base.label#3 -in $root -row 2 -column 3 -sticky nesw
grid $base.np -in $root -row 2 -column 4 -sticky nesw

grid $base.langle -in $root -row 3 -column 1 -sticky nesw
grid $base.angle -in $root -row 3 -column 2 -sticky nesw
grid $base.bimage -in $root -row 3 -column 3 -sticky nesw
grid $base.rbow -in $root -row 3 -column 4 -sticky nesw

# Row 9 (Canvas)

grid $base.cv -in $root -row 5 -column 1 -columnspan 4 -sticky
nesw

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# Row 10

grid $base.t      -in $root -row 6 -column 1 -columnspan 4 -sticky neww

grid $base.b0 -in $root                -row 7 -column 1
grid $base.plot -in $root            -row 7 -column 2
grid $base.b2 -in $root                -row 7 -column 3
grid $base.b1 -in $root                -row 7 -column 4

# additional interface code

bind .cv <Double-1> { onDbClick %x %y }
bind $base.cc <Return> {DrawFn .cv}
bind $base.np <Return> {DrawFn .cv }
bind $base.angle <Return> {DrawFn .cv }

update

# end additional interface code

set width [wininfo width .cv ]
set height [wininfo height .cv ]

DrawFn .cv
```