UNIVERSIDAD NACIONAL DE CAJAMARCA
FACULTAD DE INGENIERÍA
ESCUELA ACADÉMICO PROFESIONAL DE INGENIERÍA DE SISTEMAS

Tema:

Aplicativo en Excel

Asignatura:

INVESTIGACION DE OPERACIONES EN INGENIERIA I

Presentado por:

Caruajulca Tiglla Alex Eli

Docente:

Ing. MUÑOZ ABANTO NESTOR ELIAS

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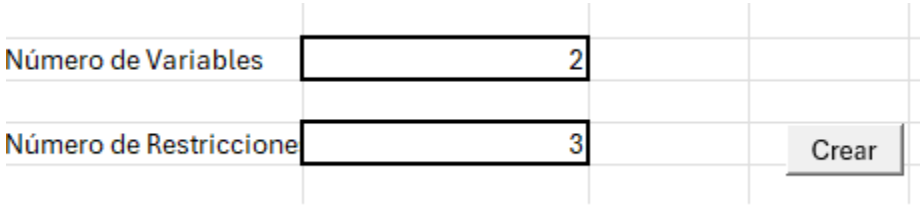
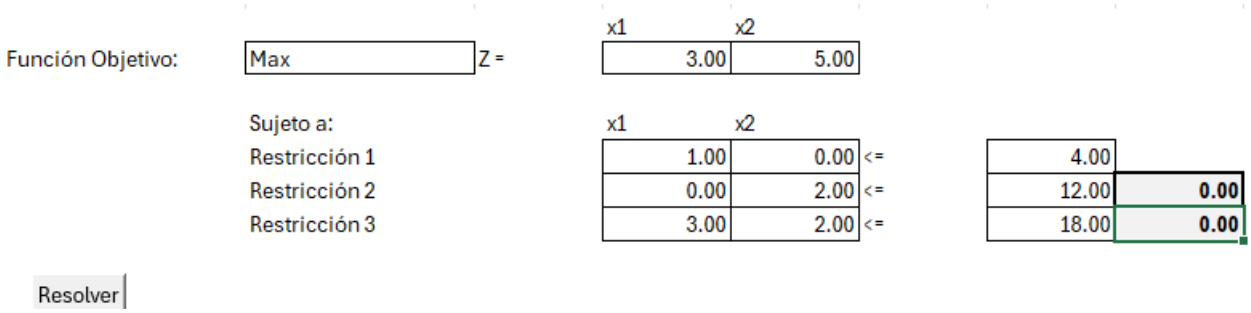
A continuación se presenta el aplicativo desarrollado en excel utilizando macros para problemas de maximización y minimización

Primero tenemos que capturar el modelo, utilizando el número de variables y restricciones para obtener una estructura donde colocar los valores



Luego de generar la estructura procedemos a colocar los valores, en este caso utilizaremos el primer ejercicio de la última práctica



Posteriormente clickeamos en el botón resolver para obtener la tabla óptima

	x1	x2	A1	h1	A2	h2	A3	h3	Solución
Z	0	0	0	0	1 1/2	0	1	0	36
A1	0	0	1	0	1/3	0	- 1/3	0	2
x2	0	1	0	0	1/2	0	0	0	6
x1	1	0	0	0	- 1/3	0	1/3	0	2

Finalmente visualizamos el resultado obtenido similar al que se obtuvo en la práctica

Para poder realizar este trabajo he utilizado macros en excel, presento todos los métodos utilizados a continuación.

Consultar archivo en google drive:
https://drive.google.com/file/d/1cp6HxamoIdGIoxETB38MZrhxwZpLNn6G/view?usp=sharing

```
Sub Iniciar()
Dim i, j, Fila, Columna As Integer
Dim nVar As Integer
Dim nRestricciones As Integer
Call Limpiar
nVar = Cells(2, 2).Value
nRestricciones = Cells(4, 2).Value
If nVar = 0 Then
```

```
MsgBox "Introduzca el número de Variables del modelo"
Range("B2").Select
Else
If nRestricciones = 0 Then
MsgBox "Introduzca el número de Restricciones del modelo"
Range("B4").Select
Else
Range("A7").Select
ActiveCell.FormulaR1C1 = "Función Objetivo:"
Call Celda_Captura(7, 2, "D")
Range("C7").Select
ActiveCell.FormulaR1C1 = "Z = "
Range("B9").Select
ActiveCell.FormulaR1C1 = "Sujeto a:"
Call desigualdad(7, 2, "Max, Min", "Max")
For i = 1 To nVar
Cells(6, 3 + i).Value = "x" & i
Call Celda_Captura(7, 3 + i, "D")
Cells(9, 3 + i).Value = "x" & i
Next i
For i = 1 To nRestricciones
Cells(9 + i, 2).Value = "Restricción " & i
For j = 1 To nVar
Call Celda_Captura(9 + i, 3 + j, "D")
Next j
Call desigualdad(9 + i, 3 + nVar + 1, "<=,=,>=", "<=")
Call Celda_Captura(9 + i, 3 + nVar + 2, "D")
Next i
ActiveSheet.Shapes.Range(Array(1)).Select
Selection.Copy
Cells(9 + nRestricciones + 2, 1).Select
ActiveSheet.Paste
Selection.ShapeRange(1).TextFrame.Characters.Text = "Resolver"

Selection.OnAction = "Matriz_Inicial"

Selection.ShapeRange(1).Name = "Boton"
ActiveSheet.Shapes("Boton").TextFrame.Characters.Text = "Resolver"
Range("B7").Select
End If
```

```
End If
End Sub

Private Sub Matriz_Inicial()
Dim nV, nR, i, j, Ren, Col As Integer
Dim nIgual, nMenor_Igual, nMayor_Igual As Integer
Dim nArtificiales As Integer
Dim nHolguras As Integer
Dim nHolguras_art As Integer
Dim nFilas, nColumnas As Integer
Dim cDesigualdad As String
Dim Valor_M As Double
Dim nMultiplicador As Integer
Dim n_Ms As Integer
Dim nCol_Pivote, nRen_Pivote As Integer
Dim nInverso As Double
Dim lShowTbl As Boolean
nTab = 0
nV = Cells(2, 2).Value
nR = Cells(4, 2).Value
nHolguras = 0
nHolguras_art = 0
nArtificiales = 0
nIgual = 0
nFilas = nR + 1
ReDim Filas(nFilas) As String
If Cells(7, 2).Value = "Min" Then
Filas(1) = " - Z"
Else
Filas(1) = "Z"
End If
For i = 1 To nR
cDesigualdad = Cells(9 + i, 3 + nV + 1).Value
If cDesigualdad = " <= " Then
nHolguras = nHolguras + 1
Filas(i + 1) = "S" & nHolguras
Else
If cDesigualdad = " = " Then
nArtificiales = nArtificiales + 1
Filas(i + 1) = "A" & nArtificiales
```

```
Else
nArtificiales = nArtificiales + 1
Filas(i + 1) = "A" & nArtificiales
nHolguras_art = nHolguras_art + 1
End If
End If
Next i
nColumnas = nV + nHolguras + nArtificiales + nHolguras_art + 1
ReDim Columnas(nColumnas) As String
ReDim Matriz(nFilas, nColumnas) As Double
i = 1
nHolguras = 0
nHolguras_art = 0
nArtificiales = 0
j = 1
While j <= nColumnas
If j = nColumnas Then
Columnas(j) = "Solución"
Else
If j <= nV Then
Columnas(j) = "x" & j
Else
cDesigualdad = Cells(9 + i, 3 + nV + 1).Value
If cDesigualdad = " <= " Then
nHolguras = nHolguras + 1
Columnas(j) = "S" & nHolguras
Else
If cDesigualdad = " = " Then
nArtificiales = nArtificiales + 1
Columnas(j) = "A" & nArtificiales
Else
nArtificiales = nArtificiales + 1
Columnas(j) = "A" & nArtificiales
nHolguras_art = nHolguras_art + 1
j = j + 1
Columnas(j) = "h" & nHolguras_art
End If
End If
i = i + 1
End If
```

```
End If
j = j + 1
Wend
For Ren = 1 To nFilas - 1
Col = 1
While Col <= nColumnas - 1
cDesigualdad = Cells(9 + Ren, 3 + nV + 1).Value
If Col <= nV Then
Matriz(Ren + 1, Col) = Cells(9 + Ren, 3 + Col)
Else
If Filas(Ren + 1) = Columnas(Col) Then
Matriz(Ren + 1, Col) = 1
Else
If (cDesigualdad = " >= " And Mid(Columnas(Col), 1, 1) = "h") Then
Matriz(Ren + 1, Col) = -1
Else
Matriz(Ren + 1, Col) = 0
End If
End If
End If
Col = Col + 1
Wend
Matriz(Ren + 1, nColumnas) = Cells(9 + Ren, 3 + nV + 2).Value
Next Ren
Valor_M = 10000
If nArtificiales > 0 Then

Valor_M = Cells(1, 2).Value
End If
If Cells(7, 2).Value = "Min" Then
nMultiplicador = 1
Else
nMultiplicador = -1
End If
For Col = 1 To nColumnas - 1
If Col <= nV Then
Matriz(1, Col) = Cells(7, 3 + Col).Value * nMultiplicador
Else
If Mid(Columnas(Col), 1, 1) = "A" Then
If Cells(7, 2).Value = "Min" Then
```

```
Matriz(1, Col) = Valor_M * nMultiplicador
Else
Matriz(1, Col) = Valor_M * nMultiplicador * -1
End If
Else
Matriz(1, Col) = 0
End If
End If
Next Col
Cells(8, 4).Select
Call Dibuja_Tabla(Matriz, Filas, Columnas, nColumnas, nR)
If nArtificiales > 0 Then
n_Ms = 0
For i = 1 To nColumnas - 1
If (i > nV) Then
If (Mid(Columnas(i), 1, 1) = "A" And Matriz(1, i) <> 0) Then
n_Ms = n_Ms + 1
nCol_Pivote = i
Exit For
End If
End If
Next i
While n_Ms > 0
For j = 2 To nFilas
If Matriz(j, nCol_Pivote) = 1 Then
nRen_Pivote = j
End If
Next j
For i = 1 To nRen_Pivote - 1
nInverso = Matriz(i, nCol_Pivote) * -1
For j = 1 To nColumnas
Matriz(i, j) = nInverso * Matriz(nRen_Pivote, j) + Matriz(i, j)
Next j
Next i
For i = nFilas To nRen_Pivote + 1 Step -1
nInverso = Matriz(i, nCol_Pivote) * -1
For j = 1 To nV + nR + 1
Matriz(i, j) = nInverso * Matriz(nRen_Pivote, j) + Matriz(i, j)
Next j
Next i
```

```
n_Ms = 0
For i = 1 To nColumnas - 1
If (i > nV) Then
If (Mid(Columnas(i), 1, 1) = "A" And Matriz(1, i) <> 0) Then
n_Ms = n_Ms + 1
nCol_Pivote = i
Exit For
End If
End If
Next i
Wend
Call Dibuja_Tabla(Matriz, Filas, Columnas, nColumnas, nR)
End If
Call SimplexM(Matriz, Filas, Columnas, nFilas, nColumnas)
End Sub

Private Sub SimplexM(Matriz, Filas, Columnas, nFilas, nColumnas)
Dim i, j, nNegativos, nCol_Pivote, nRen_Pivote, nTab As Integer
Dim nPivote, nMenor, nInverso As Double
Dim lPaso As Boolean
Dim Solucion As String
nTab = 2
lPaso = True
nNegativos = 0
For i = 1 To nColumnas - 1
If Matriz(1, i) < 0 Then
nNegativos = nNegativos + 1
End If
Next i
While nNegativos > 0
nMenor = 0
nCol_Pivote = 0
For i = 1 To nColumnas - 1
If Matriz(1, i) < nMenor Then
nMenor = Matriz(1, i)
nCol_Pivote = i
End If
Next i
nRen_Pivote = 0
nMenor = 1000000
```

```
For j = 2 To nFilas
If Matriz(j, nCol_Pivote) > 0 Then
If (Matriz(j, nColumnas) / Matriz(j, nCol_Pivote)) < nMenor Then
nMenor = (Matriz(j, nColumnas) / Matriz(j, nCol_Pivote))
nRen_Pivote = j
End If
End If
Next j
If nRen_Pivote > 0 Then
Filas(nRen_Pivote) = Columnas(nCol_Pivote)
nPivote = Matriz(nRen_Pivote, nCol_Pivote)
If nPivote <> 0 Then
For j = 1 To nColumnas
Matriz(nRen_Pivote, j) = Matriz(nRen_Pivote, j) / nPivote
Next j
For i = 1 To nRen_Pivote - 1
nInverso = Matriz(i, nCol_Pivote) * -1
For j = 1 To nColumnas
Matriz(i, j) = nInverso * Matriz(nRen_Pivote, j) + Matriz(i, j)
Next j
Next i
For i = nFilas To nRen_Pivote + 1 Step -1
nInverso = Matriz(i, nCol_Pivote) * -1
For j = 1 To nColumnas
Matriz(i, j) = nInverso * Matriz(nRen_Pivote, j) + Matriz(i, j)
Next j
Next i
Call Dibuja_Tabla(Matriz, Filas, Columnas, nColumnas, nFilas - 1)
nNegativos = 0
For i = 1 To nColumnas - 1
If Matriz(1, i) < 0 Then
nNegativos = nNegativos + 1
End If
Next i
Else
nNegativos = 0
lPaso = False
End If
Else
nNegativos = 0
```

```
lPaso = False
End If
Wend
If lPaso Then
Solucion = "Solución: " & Chr(13) & Chr(13)
Cells(9, 24 + nFilas - 1 + 3).Value = "Solución"
nTab = 1
For j = 1 To nFilas
If j = 1 Then
Cells(9 + nTab, 24 + nFilas - 1 + 3).Value = "Z = "
Cells(9 + nTab, 24 + nFilas - 1 + 4).Value = Abs(Matriz(j, nColumnas))
' Call Borde_Grueso(9 + nTab, 24 + nFilas - 1 + 4, "D")
Solucion = Solucion & " Z=" & Round(Matriz(j, nColumnas), 4) & Chr(13)
nTab = nTab + 1
Else
If Mid(Filas(j), 1, 1) = "x" Then
Cells(9 + nTab, 24 + nFilas - 1 + 3).Value = Filas(j) & " = "
Cells(9 + nTab, 24 + nFilas - 1 + 4).Value = Matriz(j, nColumnas)
Call Borde_Grueso(9 + nTab, 4 + nR + 4, "D")
Solucion = Solucion & " " & Filas(j) & "=" & Round(Matriz(j, nColumnas),
4) & Chr(13)
nTab = nTab + 1
End If
End If
Next j
MsgBox Solucion
Else
MsgBox "El Modelo no tiene solución"
End If
End Sub

Sub Limpiar()
Range("A6:x1000").Select
With Selection.Interior
.Pattern = xlSolid
.PatternColorIndex = xlAutomatic
.ThemeColor = xlThemeColorDark1
.TintAndShade = 0
.PatternTintAndShade = 0
End With
```

```
Selection.Font.Bold = False
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Selection.ClearContents
With Selection.Validation
.Delete
.Add        Type:=xlValidateInputOnly,        AlertStyle:=xlValidAlertStop,
Operator:=xlBetween
.IgnoreBlank = True
.InCellDropdown = True
.InputTitle = ""
.ErrorTitle = ""
.InputMessage = ""
.ErrorMessage = ""
.ShowInput = True
.ShowError = True
End With
If ActiveSheet.Shapes.Count >= 4 Then
ActiveSheet.Shapes.Range(Array("Boton")).Select
Selection.Delete
End If
Range("B2").Select
End Sub


Private Sub Celda_Captura(F, C, Tipo)
Cells(F, C).Select
If Selection.Value = "" Then
Selection.Value = 0
End If
Selection.Font.Bold = False
Selection.Borders(xlEdgeLeft).LineStyle = xlContinuous
Selection.Borders(xlEdgeTop).LineStyle = xlContinuous
Selection.Borders(xlEdgeBottom).LineStyle = xlContinuous
Selection.Borders(xlEdgeRight).LineStyle = xlContinuous
If Tipo = "D" Then
```

```
Selection.Style = "Comma"
Selection.NumberFormat = "0.00"
Else
Selection.NumberFormat = "# ?/?"
End If
With Selection.Validation
.Delete
.Add Type:=xlValidateDecimal, AlertStyle:=xlValidAlertStop, Operator _
:=xlBetween, Formula1:="-1000000", Formula2:="1000000"
.IgnoreBlank = True
.InCellDropdown = True
.InputTitle = ""
.ErrorTitle = ""
.InputMessage = ""
.ErrorMessage = "Solo Valores Numéricos"
.ShowInput = True
.ShowError = True
End With
End Sub

Private Sub desigualdad(F, C, Cadena, Valor)
Cells(F, C).Select
With Selection.Validation
.Delete
.Add          Type:=xlValidateList,          AlertStyle:=xlValidAlertStop,
Operator:=xlBetween, Formula1:=Cadena
.IgnoreBlank = False
.InCellDropdown = True
.InputTitle = ""
.ErrorTitle = ""
.InputMessage = "" 'Cadena
.ErrorMessage = "Tiene que incuir una desigualdad : " & Cadena
.ShowInput = True
.ShowError = True
End With
Cells(F, C).Value = Valor
End Sub


Private Sub Dibuja_Tabla(Matriz, Filas, Columnas, nColumnas, nR)
```

```
Dim i, Fil, Col As Integer
nTab = nTab + 1
For i = 1 To nColumnas
Cells(9 + nTab + (nR + 1) * nTab + 1, 3 + i).Value = Columnas(i)
Call Borde_Grueso(10 + nTab + (nR + 1) * nTab + 1, 3 + i, "F")
Next i
For Fil = 1 To nR + 1
Cells(10 + nTab + (nR + 1) * nTab + Fil, 3).Value = Filas(Fil)
For Col = 1 To nColumnas
Cells(10 + nTab + (nR + 1) * nTab + Fil, 3 + Col).Value = Matriz(Fil, Col)
Call Celda_Captura(10 + nTab + (nR + 1) * nTab + Fil, 3 + Col, "F")
Next Col
Next Fil
End Sub

Private Sub Borde_Grueso(F, C, Tipo)
Cells(F, C).Select
With Selection.Interior
.Pattern = xlSolid
.PatternColorIndex = xlAutomatic
.ThemeColor = xlThemeColorDark1
.TintAndShade = -4.99893185216834E-02
.PatternTintAndShade = 0
End With
Selection.Font.Bold = True
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
.LineStyle = xlContinuous
.Weight = xlMedium
End With
With Selection.Borders(xlEdgeTop)
.LineStyle = xlContinuous
.Weight = xlMedium
End With
With Selection.Borders(xlEdgeBottom)
.LineStyle = xlContinuous
.Weight = xlMedium
End With
With Selection.Borders(xlEdgeRight)
```

```
.LineStyle = xlContinuous
.Weight = xlMedium
End With
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
If Tipo = "D" Then
Selection.Style = "Comma"
Selection.NumberFormat = "0.00"
Else
Selection.NumberFormat = "# ?/?"
End If
If Selection.Value = "" Then
Selection.Value = 0
End If
With Selection.Validation
.Delete
.Add         Type:=xlValidateDecimal,         AlertStyle:=xlValidAlertStop,
Operator:=xlBetween, Formula1:="-1000000", Formula2:="1000000"
.IgnoreBlank = True
.InCellDropdown = True
.InputTitle = ""
.ErrorTitle = ""
.InputMessage = ""
.ErrorMessage = ""
.ShowInput = True
.ShowError = True
End With
End Sub
```