

Lampiran I: *Source Code*

```
Private Type Records
    Dimension() As Double
    Distance() As Double
    Cluster As Integer
End Type

Dim Table As Range
Dim Record() As Records
Dim Centroid() As Records

Sub Run()
'menjalankan K-means
    If Not kMeansSelection Then
        Call MsgBox("Error: " & Err.Description, vbExclamation, "kMeans
Error")
    End If
End Sub

Function kMeansSelection() As Boolean
'memasukkan tabel user
    On Error Resume Next
    Set Table = Application.InputBox(Prompt:= _
        "Please select the range to analyse.", _
        title:="Specify Range", Type:=8)
    If Table Is Nothing Then Exit Function    'Cancelled
'cek dimensi tabel
```

```

If Table.Rows.Count < 4 Or Table.columns.Count < 2 Then
    Err.Raise Number:=vbObjectError + 1000, Source:="k-Means Cluster
Analysis", Description:="Table has insufficient rows or columns."
End If
'memasukkan jumlah klaster
Dim numClusters As Integer
numClusters = Application.InputBox("Specify Number of Clusters", "k
Means Cluster Analysis", Type:=1)

If Not numClusters > 0 Or numClusters = False Then
    Exit Function    'Cancelled
End If
If Err.Number = 0 Then
    If kMeans(Table, numClusters) Then
        outputClusters
    End If
End If
kMeansSelection_Error:
    kMeansSelection = (Err.Number = 0)
End Function

Function kMeans(Table As Range, Clusters As Integer) As Boolean
'Table – range data di kelompokkan. Record (baris) dikelompokkan
berdasarkan atribut/dimensi (kolom).
'Clusters - Number of clusters to reduce records into.

On Error Resume Next

'Script Performance Variables

```

```

Dim PassCounter As Integer
'inisialisasi data array
ReDim Record(2 To Table.Rows.Count)
Dim r As Integer 'record
Dim d As Integer 'indeks dimensi
Dim d2 As Integer 'indeks dimensi
Dim c As Integer 'indeks centroid
Dim c2 As Integer 'indeks centroid
Dim di As Integer 'jarak

Dim x As Double 'Variable Distance Placeholder
Dim y As Double 'Variable Distance Placeholder

For r = LBound(Record) To UBound(Record)
'inisialisasi dimensi nilai array
ReDim Record(r).Dimension(2 To Table.columns.Count)
'inisialisasi array jarak
ReDim Record(r).Distance(1 To Clusters)
For d = LBound(Record(r).Dimension) To
UBound(Record(r).Dimension)
Record(r).Dimension(d) = Table.Rows(r).Cells(d).Value
Next d
Next r
'inisialisasi array centroid
ReDim Centroid(1 To Clusters)
Dim uniqueCentroid As Boolean

```

```

For c = LBound(Centroid) To UBound(Centroid)
    'inisialisasi kedalaman dimensi centroid
    ReDim Centroid(c).Dimension(2 To Table.columns.Count)
    'inisialisasi record untuk record selanjutnya
    r = LBound(Record) + c - 2
    Do ' loop untuk memastikan centroid baru itu unik
        r = r + 1 'menaikkan indeks record sepanjang loop atau
        pengulangan untuk menemukan record yang unik agar untuk digunakan
        sebagai centroid

        'menandai dimensi record untuk centroid
        For d = LBound(Centroid(c).Dimension) To
        UBound(Centroid(c).Dimension)
            Centroid(c).Dimension(d) = Record(r).Dimension(d)
        Next d
        uniqueCentroid = True
        For c2 = LBound(Centroid) To c - 1
            'mengulang melalui dimensi record untuk mengecek jika semua
            sama
            x = 0
            y = 0
            For d2 = LBound(Centroid(c).Dimension) To _
            UBound(Centroid(c).Dimension)
                x = x + Centroid(c).Dimension(d2) ^ 2
                y = y + Centroid(c2).Dimension(d2) ^ 2
            Next d2
        Next c2
    Next r
Next c

```

```

        uniqueCentroid = Not Sqr(x) = Sqr(y)
        If Not uniqueCentroid Then Exit For
    Next c2

    Loop Until uniqueCentroid
Next c

'menghitung jarak centroid
Dim lowestDistance As Double
Dim lastCluster As Integer
Dim ClustersStable As Boolean

Do 'sementara klaster belum stabil
    PassCounter = PassCounter + 1
    ClustersStable = True 'sampai menunjukkan
    'loop melalui record
    For r = LBound(Record) To UBound(Record)

        lastCluster = Record(r).Cluster
        lowestDistance = 0 'Reset jarak terendah

        'loop melauai record jarak ke centroid
        For c = LBound(Centroid) To UBound(Centroid)
            'menghitung jarak titik pusat atau elucidean distance
            ' d(p,q) = Sqr((q1 - p1)^2 + (q2 - p2)^2 + (q3 - p3)^2)
            '-----
            ' X = (q1 - p1)^2 + (q2 - p2)^2 + (q3 - p3)^2

```

' $d(p,q) = X$

$x = 0$

$y = 0$

'Loop melalui dimensi record

For $d = \text{LBound}(\text{Record}(r).\text{Dimension})$ To _

$\text{UBound}(\text{Record}(r).\text{Dimension})$

$y = \text{Record}(r).\text{Dimension}(d) - \text{Centroid}(c).\text{Dimension}(d)$

$y = y^2$

$x = x + y$

Next d

$x = \text{Sqr}(x)$ 'mencari akar kuadrat

'jika jarak centroid rendah maka record dijadikan klaster centroid.

If $c = \text{LBound}(\text{Centroid})$ Or $x < \text{lowestDistance}$ Then

$\text{lowestDistance} = x$

'menentukan jarak centroid ke record

$\text{Record}(r).\text{Distance}(c) = \text{lowestDistance}$

'menentukan jarak record ke centroid

$\text{Record}(r).\text{Cluster} = c$

End If

Next c

If ClustersStable Then $\text{ClustersStable} = \text{Record}(r).\text{Cluster} =$
 lastCluster

Next r

‘memindah centroid untuk dihitung rata – rata klaster

For c = LBound(Centroid) To UBound(Centroid) ‘untuk setiap klater

'loop melalui dimensi klaster

For d = LBound(Centroid(c).Dimension) To _

UBound(Centroid(c).Dimension)

Centroid(c).Cluster = 0 ‘Reset number of records in cluster

Centroid(c).Dimension(d) = 0 ‘Reset centroid dimensions

'Loop melalui record

For r = LBound(Record) To UBound(Record)

‘jika record di dalam klaster maka

If Record(r).Cluster = c Then

‘digunakan untuk menghitung rata – rata dimensi untuk record
dalam klaster

‘menambahkan angka berdasarkan jumlah record dalam
klaster

Centroid(c).Cluster = Centroid(c).Cluster + 1

‘menambahkan dimensi record ke dimensi klaster untuk
pembagian selanjutnya

Centroid(c).Dimension(d) = Centroid(c).Dimension(d) + _

Record(r).Dimension(d)

End If

Next r

‘memberi rata – rata dimenasi jarak

```

        Centroid(c).Dimension(d) = Centroid(c).Dimension(d) / _
            Centroid(c).Cluster
    Next d
Next c
Loop Until ClustersStable
kMeans = (Err.Number = 0)
End Function

```

```

Function outputClusters() As Boolean

```

```

    Dim c As Integer    'Centroid Index
    Dim r As Integer    'Row Index
    Dim d As Integer    'Dimension Index

```

```

    Dim oSheet As Worksheet

```

```

    On Error Resume Next

```

```

    Set oSheet = addWorksheet("Cluster Analysis", ActiveWorkbook)

```

```

    'Loop melalui record

```

```

    Dim rowNumber As Integer

```

```

    rowNumber = 1

```

```

    'Output Headings

```

```

    With oSheet.Rows(rowNumber)

```

```

        With .Cells(1)

```



```

        .Value = "Row Title"

        .Font.Bold = True

        .HorizontalAlignment = xlCenter

    End With

    With .Cells(2)

        .Value = "Centroid"

        .Font.Bold = True

        .HorizontalAlignment = xlCenter

    End With

End With

'Print by Row

rowNumber = rowNumber + 1    'Blank Row

For r = LBound(Record) To UBound(Record)

    oSheet.Rows(rowNumber).Cells(1).Value =
Table.Rows(r).Cells(1).Value

    oSheet.Rows(rowNumber).Cells(2).Value = Record(r).Cluster

    rowNumber = rowNumber + 1

Next r

'Print Centroids - Headings

rowNumber = rowNumber + 1

For d = LBound(Centroid(LBound(Centroid)).Dimension) To
UBound(Centroid(LBound(Centroid)).Dimension)

    With oSheet.Rows(rowNumber).Cells(d)

        .Value = Table.Rows(1).Cells(d).Value
    End With
End For

```

```

        .Font.Bold = True

        .HorizontalAlignment = xlCenter

    End With

Next d

'Print Centroids

rowNumber = rowNumber + 1

For c = LBound(Centroid) To UBound(Centroid)

    With oSheet.Rows(rowNumber).Cells(1)

        .Value = "Centroid " & c

        .Font.Bold = True

    End With

'Loop through cluster dimensions

    For d = LBound(Centroid(c).Dimension) To
UBound(Centroid(c).Dimension)

        oSheet.Rows(rowNumber).Cells(d).Value =
Centroid(c).Dimension(d)

    Next d

    rowNumber = rowNumber + 1

Next c

oSheet.columns.AutoFit    '//AutoFit columns to contents

outputClusters_Error:

    outputClusters = (Err.Number = 0)

End Function

```

```
Function addWorksheet(Name As String, Optional Workbook As Workbook)
As Worksheet
```

```
    On Error Resume Next
```

```
    '// jika Workbook tidak ada, maka menggunakan workbook yang aktif
```

```
    If Workbook Is Nothing Then Set Workbook = ActiveWorkbook
```

```
    Dim Num As Integer
```

```
    '// jika worksheet memiliki nama yang sama, maka tambahkan angka
    setelah nama
```

```
    While WorksheetExists(Name, Workbook)
```

```
        Num = Num + 1
```

```
        If InStr(Name, "(") > 0 Then Name = Left(Name, InStr(Name, "("))
```

```
        Name = Name & "(" & Num & ")"
```

```
    Wend
```

```
    '//menambahkan lembar baru ke dalam worksheet
```

```
    Set addWorksheet = Workbook.Worksheets.Add
```

```
    '//nama lembar
```

```
    addWorksheet.Name = Name
```

```
End Function
```

```
Public Function WorksheetExists(WorkSheetName As String, Workbook As
Workbook) As Boolean
```

```
    On Error Resume Next
```

```
    WorksheetExists = (Workbook.Sheets(WorkSheetName).Name <> "")
```

```
    On Error GoTo 0
```

```
End Function
```