**LAPORAN AKHIR**

**SISTEM CERDAS DAN PENDUKUNG KEPUTUSAN**

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# **KATA PENGANTAR**

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Penyusun Penyusun

Wijdan Akhmad Subarkat Mohamad Risqi Aditiya

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# **BAB 1**

# **STUDI KASUS**

## **1.1 Permasalahan :**

Suatu perusahaan jasa ekspedisi melayani pengiriman paket dengan karakteristik permintaan yang berfluktuasi setiap hari. Dari data satu bulan terakhir, permintaan tertinggi mencapai 6000 paket/hari, dan permintaan terendah sampai 1500 paket/hari.

Persediaan kendaraan dan kapasitas di gudang juga bervariasi, dengan jumlah maksimal 80 kendaraan dan minimal 10 kendaraan tersedia setiap hari.

Dengan segala keterbatasannya, perusahaan baru mampu menangani maksimum 7000 paket/hari dan demi efisiensi, perusahaan paling tidak harus menangani 2500 paket/hari.

Perusahaan ingin menggunakan logika fuzzy untuk menentukan jumlah paket yang harus ditangani setiap hari berdasarkan data permintaan dan persediaan kendaraan.

## **1.2 Ditanyakan :**

Berapa jumlah paket yang harus ditangani oleh perusahaan jasa ekspedisi, jika permintaan sebanyak 4500 paket dan persediaan kendaraan di gudang adalah 50 kendaraan?

# **BAB 2**

# **PERHITUNGAN**

## **2.1 Definisi Awal**

Terdapat 3 Variabel Himpunan :

1. Permintaan

permintaan tinggi mencapai 6000 paket/hari (Naik = 6000 paket/hari).

permintaan terendah sampai 1500 paket/hari (Turun = 1500 paket/hari).

1. Persedian

jumlah maksimal 80 kendaraan (Banyak = 80 kendaraan).

jumlah minimal 10 kendaraan tersedia setiap hari (Sedikit = 10 kendaraan).

1. Jumlah Paket

menangani maksimum 7000 paket/hari (Bertambah = 7000 paket/hari).

paling tidak harus menangani 2500 paket/hari (Berkurang = 2500 paket/hari).

Jika Permintaan sebanyak 4500 paket dan persedian kendaraan di gudang adalah 50 kendaraan.

Maka

Permintaan = 4500 paket/hari.

Persedian = 50 kendaraan.

## **2.2 Aturan Fuzzy**

Aturan Fuzzy yang digunakan :

R1 : IF permintaan turun AND persediaan banyak THEN jumlah paket berkurang.

R2 : IF permintaan turun AND persediaan sedikit THEN jumlah paket berkurang.

R3 : IF permintaan naik AND persediaan banyak THEN jumlah paket bertambah.

R4 : IF permintaan naik AND persediaan sedikit THEN jumlah paket bertambah.

## **2.3 Rumus Fuzzy**

Menerapkan fuzzy untuk setiap variabelnya :

1. Variabel Permintaan

|  |  |
| --- | --- |
| μ Permintaan **TURUN[x]** | μ Permintaan **NAIK[x]** |
|  |  |

**Derajat/nilai Keanggotaan :**

|  |  |
| --- | --- |
| μ Permintaan **TURUN[4500]**  = (6000 - 4500) / 6000 - 1500  = 1500 / 4500  = **0,333** | μ Permintaan **NAIK[4500]**  = (4500 - 1500) / 6000 - 1500  = 3000 / 4500  = **0,667** |

1. Variabel Persedian

|  |  |
| --- | --- |
| μ Persedian **SEDIKIT[y]** | μ Persedian **BANYAK[y]** |
|  |  |

**Derajat/nilai Keanggotaan :**

|  |  |
| --- | --- |
| μ Persedian **SEDIKIT[50]**  = (80 - 50) / 80 - 10  = 30 / 70  = **0,429** | μ Persedian **BANYAK[50]**  = (50 - 10) / 80 - 10  = 40 / 70  = **0,572** |

1. Variabel Jumlah Paket

|  |  |
| --- | --- |
| μ Jumlah Paket **BERKURANG[z]** | μ Jumlah Paket **BERTAMBAH[z]** |
|  |  |

## **2.4 Penerapan Aturan Fuzzy**

Penerapan Aturan Fuzzy dengan rumus fuzzy yang sudah didapatkan :

1. Aturan 1

R1: IF permintaan **turun** AND persediaan **banyak** THEN jumlah paket **berkurang**

α predikat1 = μPermintaanTURUN റ μPersediaanBANYAK

= min(μPermintaanTURUN[4500] റ μPersediaanBANYAK[50])

= min(0,333 : 0,667) = **0,333**

Untuk α predikat1 = 0,33 pada himpunan jumlahPaketBERKURANG

= (7000 - z) / (7000-2500) = 0,333

⇒ **z1 = 5500,00**

1. Aturan 2

R2: IF permintaan **turun** AND persediaan **sedikit** THEN jumlah paket **berkurang**

α predikat2 = μPermintaanTURUN റ μPersediaanSEDIKIT

= min(μPermintaanTURUN[4500] റ μPersediaanSEDIKIT[50])

= min(0,333 : 0,429) = **0,333**

Untuk α predikat2 = 0,33 pada himpunan jumlahPaketBERKURANG

= (7000 - z) / (7000-2500) = 0,333

⇒ **z2 = 5500,00**

1. Aturan 3

R3: IF permintaan **naik** AND persediaan **banyak** THEN jumlah paket **bertambah**

α predikat3 = μPermintaanNAIK റ μPersediaanBANYAK

= min(μPermintaanNAIK[4500] റ μPersediaanBANYAK[50])

= min(0,667 : 0,571) = **0,571**

Untuk α predikat3 = 0,571 pada himpunan jumlahPaketBERTAMBAH

= (z - 2500) / (7000-2500) = 0,571

⇒ **z3 = 5071,43**

1. Aturan 4

R4: IF permintaan **naik** AND persediaan **sedikit** THEN jumlah paket **bertambah**

α predikat4 = μPermintaanNAIK റ μPersediaanSEDIKIT

= min(μPermintaanNAIK[4500] റ μPersediaanSEDIKIT[50])

= min(0,667: 0.429) = **0,429**

Untuk α predikat1 = 0,33 pada himpunan jumlahPaketBERTAMBAH

= (z - 2500) / (7000-2500) = 0,429

⇒ **z4 = 4428,57**

## **2.5 Menentukan Output CRISP**

Pada metode TSUKAMOTO untuk menentukan output crisp menggunakan rata-rata berbobot yaitu :





= 8462,69 / 1,667 = **5077,55**

Jadi jumlah paket yang harus ditangani **5077,55,** dibulatkan **5078**

# **BAB 3**

# **SOURCE CODE**

## **3.1 Source Code Program Matlab**

|  |
| --- |
| function varargout = fuzzy\_gui(varargin)  % FUZZY\_GUI MATLAB code for fuzzy\_gui.fig  % FUZZY\_GUI, by itself, creates a new FUZZY\_GUI or raises the existing  % singleton\*.  %  % H = FUZZY\_GUI returns the handle to a new FUZZY\_GUI or the handle to  % the existing singleton\*.  %  % FUZZY\_GUI('CALLBACK',hObject,eventData,handles,...) calls the local  % function named CALLBACK in FUZZY\_GUI.M with the given input arguments.  %  % FUZZY\_GUI('Property','Value',...) creates a new FUZZY\_GUI or raises the  % existing singleton\*. Starting from the left, property value pairs are  % applied to the GUI before fuzzy\_gui\_OpeningFcn gets called. An  % unrecognized property name or invalid value makes property application  % stop. All inputs are passed to fuzzy\_gui\_OpeningFcn via varargin.  %  % \*See GUI Options on GUIDE's Tools menu. Choose "GUI allows only one  % instance to run (singleton)".  %  % See also: GUIDE, GUIDATA, GUIHANDLES  % Edit the above text to modify the response to help fuzzy\_gui  % Last Modified by GUIDE v2.5 31-May-2024 09:40:24  % Begin initialization code - DO NOT EDIT  gui\_Singleton = 1;  gui\_State = struct('gui\_Name', mfilename, ...  'gui\_Singleton', gui\_Singleton, ...  'gui\_OpeningFcn', @fuzzy\_gui\_OpeningFcn, ...  'gui\_OutputFcn', @fuzzy\_gui\_OutputFcn, ...  'gui\_LayoutFcn', [] , ...  'gui\_Callback', []);  if nargin && ischar(varargin{1})  gui\_State.gui\_Callback = str2func(varargin{1});  end  if nargout  [varargout{1:nargout}] = gui\_mainfcn(gui\_State, varargin{:});  else  gui\_mainfcn(gui\_State, varargin{:});  end  % End initialization code - DO NOT EDIT  % --- Executes just before fuzzy\_gui is made visible.  function fuzzy\_gui\_OpeningFcn(hObject, eventdata, handles, varargin)  % This function has no output args, see OutputFcn.  % hObject handle to figure  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  % varargin command line arguments to fuzzy\_gui (see VARARGIN)  % Choose default command line output for fuzzy\_gui  handles.output = hObject;  % Update handles structure  guidata(hObject, handles);  % UIWAIT makes fuzzy\_gui wait for user response (see UIRESUME)  % uiwait(handles.figure1);  % --- Outputs from this function are returned to the command line.  function varargout = fuzzy\_gui\_OutputFcn(hObject, eventdata, handles)  % varargout cell array for returning output args (see VARARGOUT);  % hObject handle to figure  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  % Get default command line output from handles structure  varargout{1} = handles.output;  function permintaan\_Callback(hObject, eventdata, handles)  % hObject handle to permintaan (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  % Hints: get(hObject,'String') returns contents of permintaan as text  % str2double(get(hObject,'String')) returns contents of permintaan as a double  % --- Executes during object creation, after setting all properties.  function permintaan\_CreateFcn(hObject, eventdata, handles)  % hObject handle to permintaan (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles empty - handles not created until after all CreateFcns called  % Hint: edit controls usually have a white background on Windows.  % See ISPC and COMPUTER.  if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))  set(hObject,'BackgroundColor','white');  end  function persedian\_Callback(hObject, eventdata, handles)  % hObject handle to persedian (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  % Hints: get(hObject,'String') returns contents of persedian as text  % str2double(get(hObject,'String')) returns contents of persedian as a double  % --- Executes during object creation, after setting all properties.  function persedian\_CreateFcn(hObject, eventdata, handles)  % hObject handle to persedian (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles empty - handles not created until after all CreateFcns called  % Hint: edit controls usually have a white background on Windows.  % See ISPC and COMPUTER.  if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))  set(hObject,'BackgroundColor','white');  end  function jmlPaket\_Callback(hObject, eventdata, handles)  % hObject handle to jmlPaket (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  % Hints: get(hObject,'String') returns contents of jmlPaket as text  % str2double(get(hObject,'String')) returns contents of jmlPaket as a double  % --- Executes during object creation, after setting all properties.  function jmlPaket\_CreateFcn(hObject, eventdata, handles)  % hObject handle to jmlPaket (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles empty - handles not created until after all CreateFcns called  % Hint: edit controls usually have a white background on Windows.  % See ISPC and COMPUTER.  if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))  set(hObject,'BackgroundColor','white');  end  % --- Executes on button press in pushbutton1.  function pushbutton1\_Callback(hObject, eventdata, handles)  % hObject handle to pushbutton1 (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles structure with handles and user data (see GUIDATA)  permin1 = get(handles.permintaan, 'string');  persed1 = get(handles.persedian, 'string');  if isempty(permin1) && isempty(persed1)  errordlg('Masukan permintaan dan persedian terlebih dahulu', 'Error');  return;  end  permin = str2double(permin1);  persed = str2double(persed1);  fis = readfis('fuzzy.fis');  % Debug: cek FIS apakah benar  if isempty(fis)  errordlg('File FIS tidak ada, cari terlebih dahulu fis nya', 'Error');  return;  end  % Plot fungsi untuk Permintaan  axes(handles.axes1);  plotmf(fis, 'input', 1);  title('Permintaan');  xlabel('Permintaan');  ylabel('Membership Value');  hold on;  % Tambah vertikal untuk nilai  stem(permin, 1, 'r');  hold off;  % Plot fungsi untuk Persediaan  axes(handles.axes2);  plotmf(fis, 'input', 2);  title('Persedian');  xlabel('Persedian');  ylabel('Membership Value');  hold on;  % Tambah vertikal untuk nilai  stem(persed, 1, 'r');  hold off;  % Eval  result = evalfis([permin, persed], fis);  % Plot fungsi untuk Hasil  axes(handles.axes3);  plotmf(fis, 'output', 1);  title('Jumlah Paket');  xlabel('Jumlah Paket');  ylabel('Membership Value');  hold on;  % Tambah vertikal untuk nilai  stem(result, 1, 'r');  hold off;  % display  set(handles.jmlPaket, 'string', num2str(result));  % --- Executes during object creation, after setting all properties.  function axes1\_CreateFcn(hObject, eventdata, handles)  % hObject handle to axes1 (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles empty - handles not created until after all CreateFcns called  % Hint: place code in OpeningFcn to populate axes1  % --- Executes during object creation, after setting all properties.  function axes2\_CreateFcn(hObject, eventdata, handles)  % hObject handle to axes2 (see GCBO)  % eventdata reserved - to be defined in a future version of MATLAB  % handles empty - handles not created until after all CreateFcns called  % Hint: place code in OpeningFcn to populate axes2 |

**Tabel 3.1. Source Code Matlab ‘fuzzy\_gui.m’**

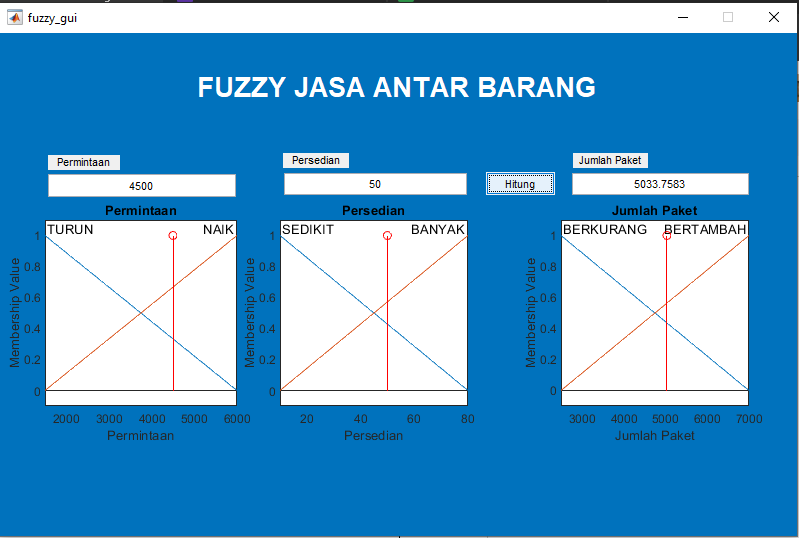
|  |
| --- |
| **[**System]  Name='fuzzy'  Type='mamdani'  Version=2.0  NumInputs=2  NumOutputs=1  NumRules=4  AndMethod='min'  OrMethod='max'  ImpMethod='min'  AggMethod='max'  DefuzzMethod='centroid'  [Input1]  Name='Permintaan'  Range=[1500 6000]  NumMFs=2  MF1='TURUN':'trimf',[1500 1500 6000]  MF2='NAIK':'trimf',[1500 6000 6000]  [Input2]  Name='Persedian'  Range=[10 80]  NumMFs=2  MF1='SEDIKIT':'trimf',[10 10 80]  MF2='BANYAK':'trimf',[10 80 80]  [Output1]  Name='JmlPaket'  Range=[2500 7000]  NumMFs=2  MF1='BERKURANG':'trimf',[2500 2500 7000]  MF2='BERTAMBAH':'trimf',[2500 7000 7000]  [Rules]  1 2, 1 (1) : 1  1 1, 1 (1) : 1  2 2, 2 (1) : 1  2 1, 2 (1) : 1 |

**Tabel 3.2. Source Code Matlab ‘fuzzy.fis’**

## **3.2 Screenshot Program**

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**Gambar 3.1. Tampilan Awal Program**



**Gambar 3.2. Setelah diinputkan data sesuai soal**