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

DAFTAR ISI

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).
2. Persedian
   jumlah maksimal 80 kendaraan (Banyak = 80 kendaraan).
   jumlah minimal 10 kendaraan tersedia setiap hari (Sedikit = 10 kendaraan).
3. 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]**

$$\begin{cases} 1 & x \leq 1500 \\ \dfrac{6000 - x}{6000 - 1500} & 1500 < x < 6000 \\ 0 & x \geq 6000 \end{cases}$$

μ Permintaan **NAIK[x]**

$$\begin{cases} 0 & x \leq 1500 \\ \dfrac{x - 1500}{6000 - 1500} & 1500 < x < 6000 \\ 1 & x \geq 6000 \end{cases}$$

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**

2. Variabel Persedian

µ Persedian **SEDIKIT[y]**

$$\begin{cases} 1 & y \leq 10 \\ \dfrac{80 - y}{80 - 10} & 10 < y < 80 \\ 0 & y \geq 80 \end{cases}$$

µ Persedian **BANYAK[y]**

$$\begin{cases} 0 & y \leq 10 \\ \dfrac{y - 10}{80 - 10} & 10 < y < 80 \\ 1 & y \geq 80 \end{cases}$$

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**

3. Variabel Jumlah Paket

µ Jumlah Paket **BERKURANG[z]**

$$\begin{cases} 1 & z \leq 2500 \\ \dfrac{7000 - z}{7000 - 2500} & 2500 < z < 7000 \\ 0 & z \geq 7000 \end{cases}$$

µ Jumlah Paket **BERTAMBAH[z]**

$$\begin{cases} 0 & z \leq 2500 \\ \dfrac{z - 2500}{7000 - 2500} & 2500 < z < 7000 \\ 1 & z \geq 7000 \end{cases}$$

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 ∩ μPersediaanBANYAK
= min(μPermintaanTURUN[4500] ∩ 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

2. Aturan 2

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

α predikat2 = μPermintaanTURUN ∩ μPersediaanSEDIKIT
= min(μPermintaanTURUN[4500] ∩ 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

3. Aturan 3

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

α predikat3 = μPermintaanNAIK ∩ μPersediaanBANYAK

= min(μPermintaanNAIK[4500] ∩ 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**

4. Aturan 4

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

α predikat4 = μPermintaanNAIK ∩ μPersediaanSEDIKIT

= min(μPermintaanNAIK[4500] ∩ 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 :

$$z = \frac{a1z1 + a2z2 + a3z3 + a4z4}{a1 + a2 + a3 + a4}$$

$$= \frac{0{,}333 * 5500{,}00 \ + \ 0{,}333 * 5500{,}00 \ + \ 0{,}571 * 5071{,}43 \ + \ 0{,}429 * 4428{,}57}{0{,}333 + 0{,}333 + 0{,}571 + 0{,}429}$$

= 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
```

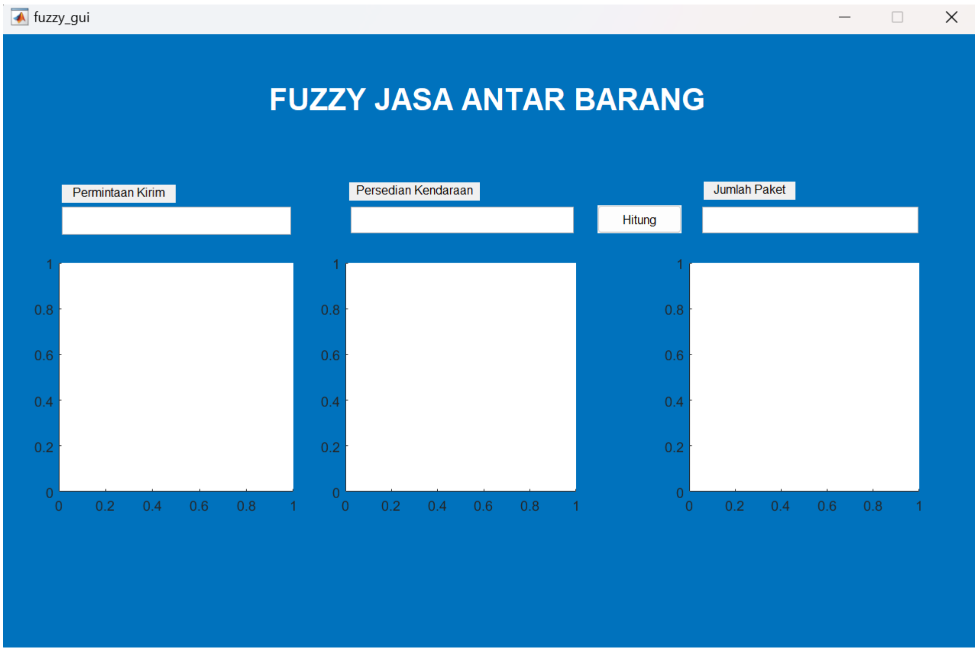
Tabel 3.1. Source Code Matlab 'fuzzy_gui.m'

```
[System]
Name='fuzzy'
Type='mamdani'
Version=2.0
NumInputs=2
NumOutputs=1
NumRules=4
AndMethod='min'
```

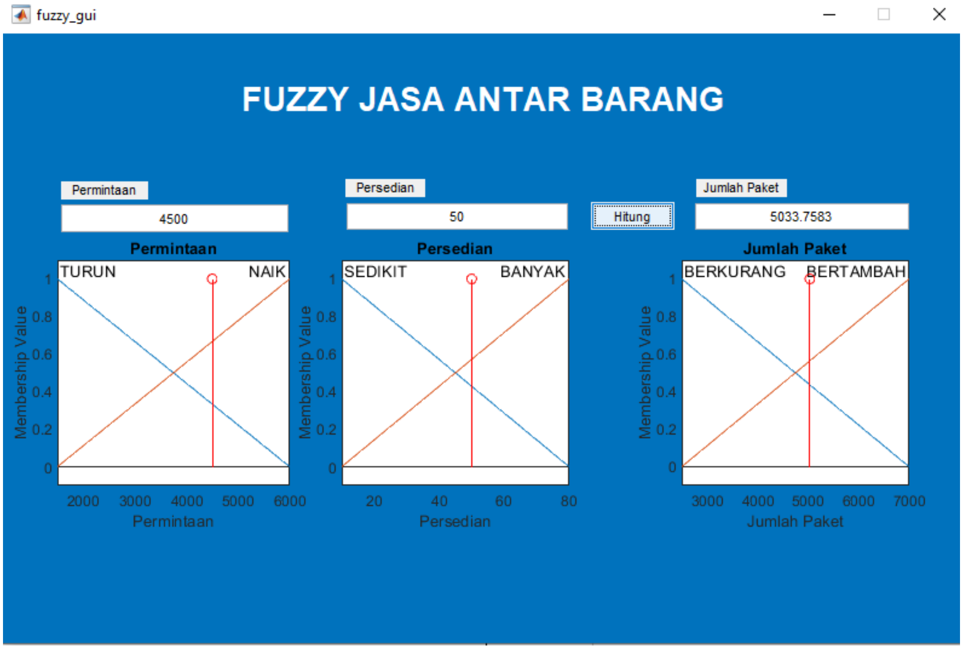
```
OrMethod='max'
ImpMethod='min'
AggMethod='max'
DefuzzMethod='centroid'

[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



Gambar 3.1. Tampilan Awal Program



Permintaan: 4500

Persedian: 50

Jumlah Paket: 5033.7583

Gambar 3.2. Setelah diinputkan data sesuai soal