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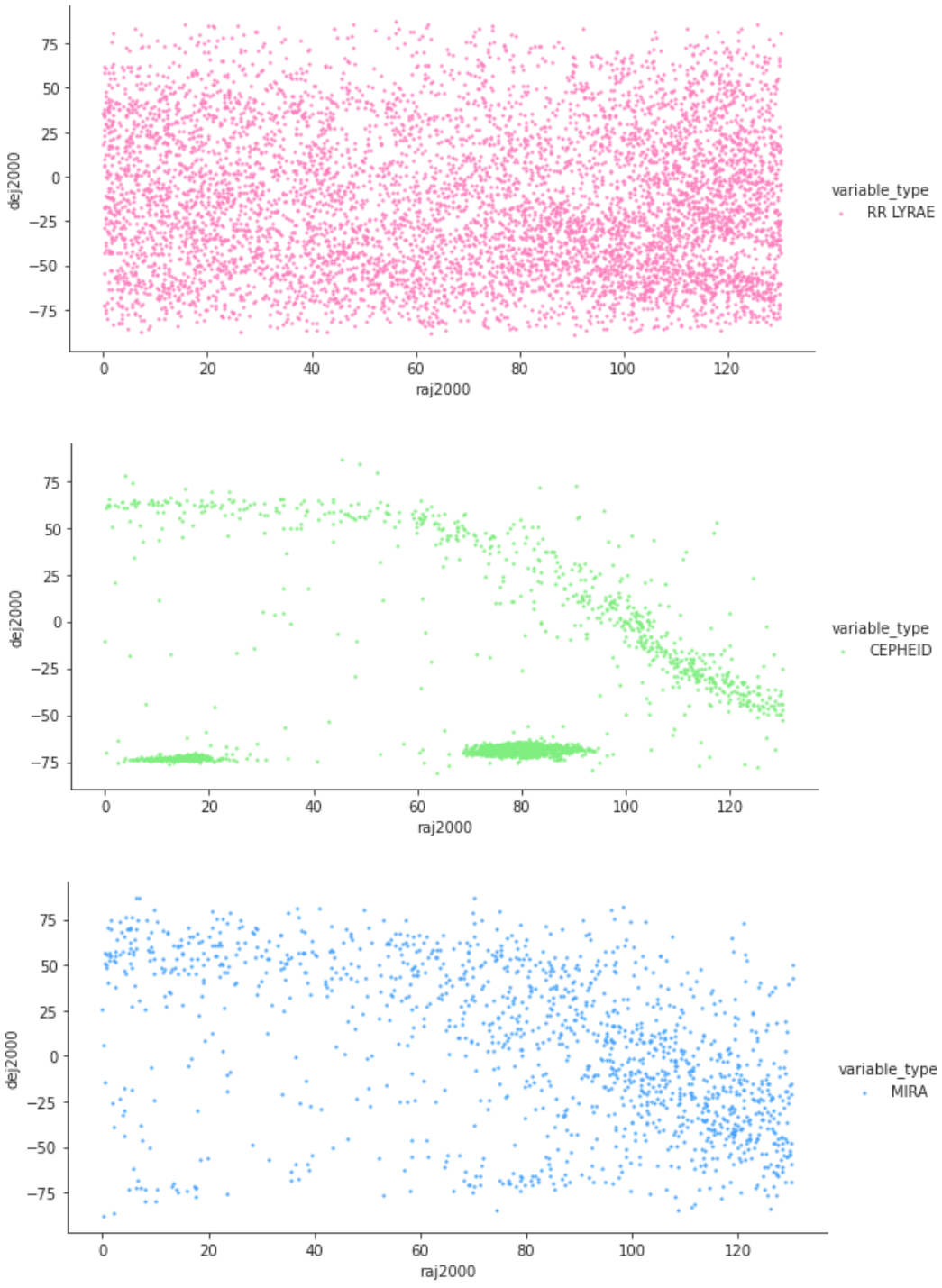
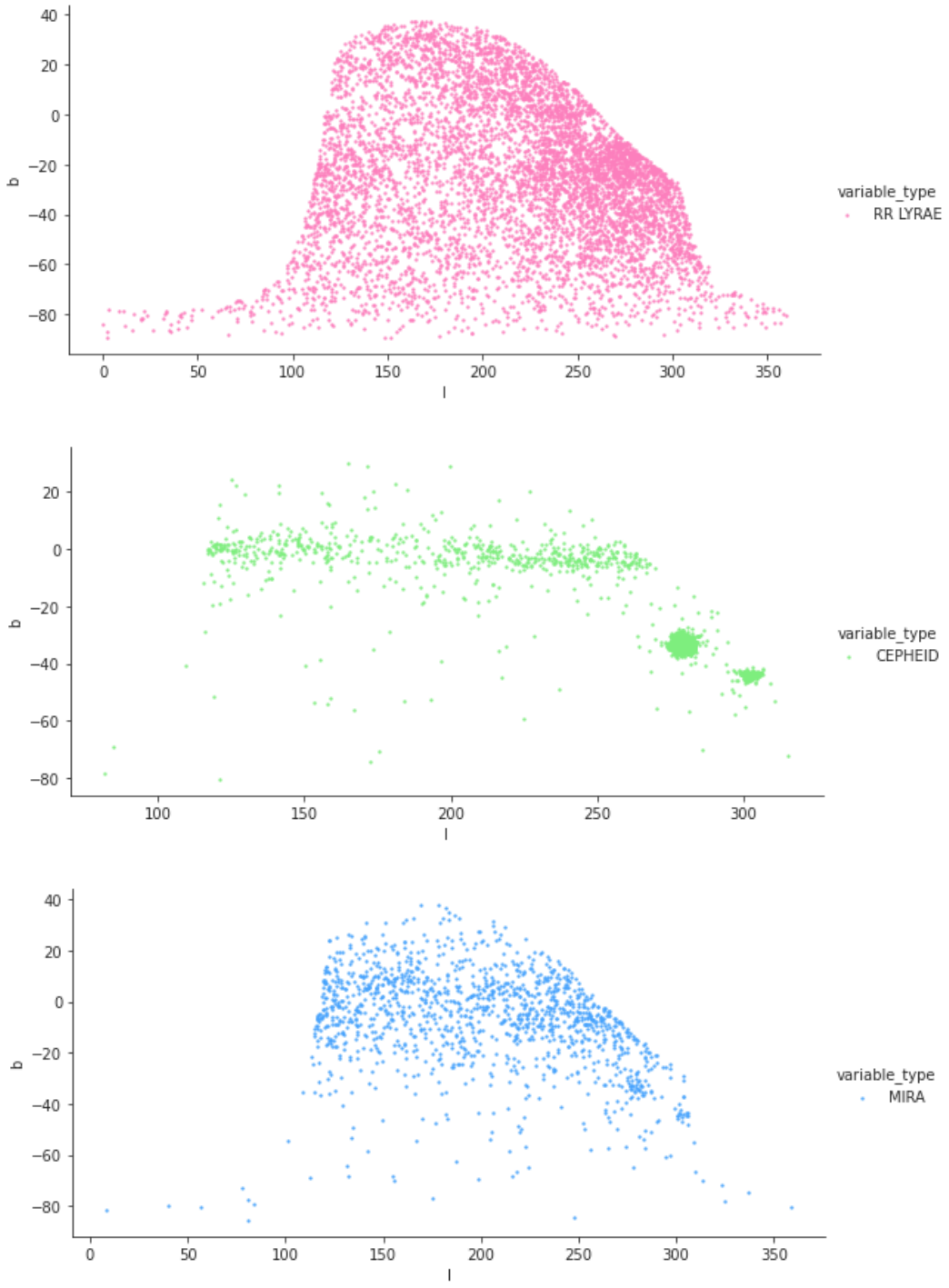
LAMPIRAN

Lampiran 1. Plot sebaran data untuk sistem koordinat ekuator



Lampiran 2. Plot sebaran data untuk sistem koordinat galaksi



Lampiran 3. Sampel dataset bintang RR Lyrae, Cepheid dan Mira

raj2000	dej2000	l	b	mean_vmag	amplitude	period	lksl_statistic	parallax	variable_type
0.01539	35.36278	111.261	-26.3419	12.97	0.78	0.706759	0.01	0.2359	RR LYRAE
0.01667	18.40663	106.229	-42.7928	13.81	0.31	0.485132	0.09	0.1137	RR LYRAE
0.0317	34.67396	111.105	-27.0166	15.94	1.25	0.461959	0.06	0.1296	RR LYRAE
0.03901	5.58986	100.2803	-55.0106	16.17	0.78	0.576022	0.19	0.063	RR LYRAE
0.06311	-72.7794	308.1468	-43.8269	14.32	0.36	0.594614	1.08	3.2226	RR LYRAE
0.06755	-72.7788	308.1452	-43.8278	14.37	0.4	0.594613	0.11	0.0384	RR LYRAE
0.07586	19.54873	106.7134	-41.707	15.76	0.99	0.545477	0.13	-0.0227	RR LYRAE
0.0759	-17.0725	70.68639	-74.4828	16.98	1.21	0.518283	0.36	0.0234	RR LYRAE
0.09862	36.32839	111.5694	-25.4146	14.25	0.76	0.562463	0.03	0.2071	RR LYRAE
0.13323	22.9941	107.9373	-38.3909	14.77	0.49	0.590645	0.13	0.0615	RR LYRAE
0.1343	-54.2952	318.4457	-61.2733	15.56	0.61	0.669873	0.09	0.0924	RR LYRAE
0.13748	61.69864	116.9385	-0.57952	11.89	0.14	0.413001	0.15	1.4142	RR LYRAE
0.14839	26.66364	109.0709	-34.8359	13.2	0.78	0.56605	0.05	0.314	RR LYRAE
0.16704	9.7885	102.7695	-51.0849	16.92	0.67	0.656768	0.47	-0.0001	RR LYRAE
0.18439	37.84296	112.0024	-23.9504	13.05	0.4	0.291503	0.1	0.3819	RR LYRAE
0.18643	-43.1332	332.3585	-70.9818	15.2	0.49	0.333485	0.17	0.1149	RR LYRAE
0.20498	-28.8167	21.39784	-78.7028	14.69	0.61	0.582931	0.26	0.0742	RR LYRAE
0.20659	6.23398	100.931	-54.4615	16.93	1.17	0.495772	0.37	-0.1044	RR LYRAE
0.21492	-17.01	71.19651	-74.5378	16.26	0.83	0.604133	0.45	0.1253	RR LYRAE
0.07344	-10.2214	85.02348	-69.2379	15.07	1.31	1.14678	0.07	0.0224	CEPHEID
0.2467	60.95902	116.8455	-1.31514	11.38	0.79	4.365282	0.01	0.2683	CEPHEID
0.25451	-69.8578	309.2168	-46.6504	17.02	1.11	1.529948	0.28	0.017	CEPHEID
0.44156	62.42413	117.2188	0.10464	13.8	0.52	3.878417	0.07	0.1961	CEPHEID
0.64578	65.08828	117.8136	2.70316	11.51	0.26	11.00848	0.64	0.3207	CEPHEID
0.67382	61.86104	117.2186	-0.46881	12.82	0.58	4.305645	0.02	0.2435	CEPHEID
0.92004	62.52984	117.4558	0.16695	14.5	0.17	2.005125	0.33	0.251	CEPHEID
1.2117	50.23485	115.3467	-11.9495	11.44	0.36	9.212942	1.1	0.1805	CEPHEID
1.77338	61.95959	117.7456	-0.4648	14.24	0.53	1.500029	0.51	0.1882	CEPHEID
1.9138	20.84894	109.3614	-40.8663	14.67	0.55	1.115191	0.05	0.0664	CEPHEID
2.33904	-63.6205	310.6561	-52.8721	15.91	0.9	1.55038	0.31	0.0727	CEPHEID
2.464	61.51402	117.9942	-0.95844	11.07	0.22	3.672348	1.02	0.3665	CEPHEID
2.59985	-75.1772	306.4292	-41.6713	14.8	0.86	10.09257	0.03	-0.0256	CEPHEID
3.3139	63.6033	118.7032	1.04549	15.38	0.47	1.747122	0.98	0.1249	CEPHEID
3.45147	64.05583	118.8296	1.48424	15.66	0.39	2.327919	0.51	0.0607	CEPHEID
3.51355	60.98619	118.4127	-1.55711	12.51	0.84	3.630273	0.01	0.2518	CEPHEID
3.71345	-74.4273	306.2481	-42.4646	16.74	0.72	1.649107	0.52	0.0005	CEPHEID
3.92611	78.00798	121.0153	15.26941	11.71	0.31	34.05345	0.12	0.4532	CEPHEID
3.98682	-73.0081	306.5168	-43.8723	16.36	0.59	2.231125	0.6	-0.0414	CEPHEID

0.02749	25.88649	108.7131	-35.5641	10.82	3.25	321.6783	0.03	1.5204	MIRA
0.2292	-87.9074	303.4559	-29.1693	14.8	3.26	331.2204	0.4	0.3812	MIRA
0.25543	6.45742	101.1376	-54.2671	14.08	4.9	267.1258	0.08	0.3729	MIRA
0.3394	51.20373	114.9814	-10.8933	15.18	3.05	314.6793	0.06	0.1922	MIRA
0.53087	-14.6758	77.77968	-73.0621	12.04	5.56	353.0886	0.14	0.921	MIRA
0.5835	57.03705	116.2612	-5.19735	15.57	2.04	327.3993	0.05	0.1733	MIRA
0.68419	48.71417	114.7082	-13.3784	13.61	4.13	396.38	0.14	0.3258	MIRA
0.83942	55.68113	116.1445	-6.55571	12.28	3.45	417.9539	0.04	1.7048	MIRA
0.8728	49.89993	115.0643	-12.238	13.6	3.8	374.569	0.07	0.4042	MIRA
1.06874	70.69125	119.0179	8.17876	14.83	2.45	378.8023	0.03	0.5278	MIRA
1.08325	40.11011	113.2488	-21.8743	10.69	4.39	313	0.17	0.9045	MIRA
1.16937	55.53775	116.3024	-6.73095	13.25	4.19	372.6691	0.02	0.3524	MIRA
1.37163	56.38388	116.5675	-5.91899	14.66	3.71	248.3	0.1	0.133	MIRA
1.37204	52.88261	115.9358	-9.36384	14.61	2.11	271.9962	0.04	0.1047	MIRA
1.47341	74.9655	119.9268	12.36012	14.59	2.63	276.5667	0.09	0.3651	MIRA
1.51225	55.20047	116.4346	-7.09766	15.62	5.18	336.1928	0.03	0.0399	MIRA
1.55928	70.06725	119.0682	7.53532	11.29	2.23	343.0115	0.26	0.9156	MIRA
1.90099	-25.4944	39.91191	-80.0454	13.12	4.13	420.5105	0.08	0.5247	MIRA
2.07403	52.76577	116.3386	-9.55281	14.67	3.61	373.7546	0.06	0.4282	MIRA

Lampiran 4. Sintaks simulasi menggunakan Scilab

```
clear
clc

// Import file
sheet=readxls("dataangka1.xls")
S1=sheet(1);
y=S1.value
sheet=readxls("datahasil.xls")
Sh=sheet(1);
h=Sh.text
[b k]=size(y)

Rand=rand(b,1)

ml=1
mu=1

// Bilangan acak (random)
for r=1:1:b
   if Rand(r,1) <= 0.6
      yl(ml,:)=y(r,:);
      hl(ml,1)=h(r,1);
      ml=ml+1;
   end
   if Rand(r,1) > 0.6
      yu(mu,:)=y(r,:);
      hu(mu,1)=h(r,1);
      mu=mu+1;
   end
end

[bl kl]=size(yl) // data latih dari file angka
[bu ku]=size(yu) // data uji dari file angka
[bhl khl]=size(hl) // data latih dari file tipe
[bhu khu]=size(hu) // data uji dari file tipe

// Data latih
// Mengelompokkan berdasarkan tipe

cl=1
rl=1
ml=1
```

```
for i=1:1:bhl
   if hl(i,:)=='CEPHEID'
      data_cyl(cl,:)=yl(i,:);
      data_chl(cl,1)=hl(i,1);
      cl=cl+1;
   end
   if hl(i,:)=='RR LYRAE'
      data_rryl(rl,:)=yl(i,:);
      data_rrhl(rl,1)=hl(i,1);
      rl=rl+1;
   end
   if hl(i,:)=='MIRA'
      data_myl(ml,:)=yl(i,:);
      data_mhl(ml,1)=hl(i,1);
      ml=ml+1;
   end
end

// Data Uji

cu=1
ru=1
mu=1

for i=1:1:bhu
   if hu(i,:)=='CEPHEID'
      data_cyu(cu,:)=yu(i,:);
      data_chu(cu,1)=hu(i,1);
      cu=cu+1;
   end
   if hu(i,:)=='RR LYRAE'
      data_rryu(ru,:)=yu(i,:);
      data_rrhu(ru,1)=hu(i,1);
      ru=ru+1;
   end
   if hu(i,:)=='MIRA'
      data_myu(mu,:)=yu(i,:);
      data_mhu(mu,1)=hu(i,1);
      mu=mu+1;
   end
end

// Rata-rata data latih

// Cepheid
```

```
[bcl kcl]=size(data_cyl) // data latih dari file angka (cepheid)
[bchl kchl]=size(data_chl) // data latih dari file tipe (cepheid)

dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
dumlksl=0
dumpar=0

for r=1:1:bcl
   dumraj=dumraj+data_cyl(r,1);
   dumde=dumde+data_cyl(r,2);
   duml=duml+data_cyl(r,3);
   dumb=dumb+data_cyl(r,4);
   dumvmag=dumvmag+data_cyl(r,5);
   dumamp=dumamp+data_cyl(r,6);
   dumper=dumper+data_cyl(r,7);
   dumlksl=dumlksl+data_cyl(r,8);
   dumpar=dumpar+data_cyl(r,9);
end

rata_c(1,1)=dumraj/bcl
rata_c(1,2)=dumde/bcl
rata_c(1,3)=duml/bcl
rata_c(1,4)=dumb/bcl
rata_c(1,5)=dumvmag/bcl
rata_c(1,6)=dumamp/bcl
rata_c(1,7)=dumper/bcl
rata_c(1,8)=dumlksl/bcl
rata_c(1,9)=dumpar/bcl

// RR Lyrae
[brl krl]=size(data_rryl) // data latih dari file angka (rr lyrae)
[brhl krhl]=size(data_rrhl) // data latih dari file tipe (rr lyrae)

dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
```

```
dumlksl=0
dumpar=0

for r=1:1:brl
   dumraj=dumraj+data_rryl(r,1);
   dumde=dumde+data_rryl(r,2);
   duml=duml+data_rryl(r,3);
   dumb=dumb+data_rryl(r,4);
   dumvmag=dumvmag+data_rryl(r,5);
   dumamp=dumamp+data_rryl(r,6);
   dumper=dumper+data_rryl(r,7);
   dumlksl=dumlksl+data_rryl(r,8);
   dumpar=dumpar+data_rryl(r,9);
end

rata_r(1,1)=dumraj/brl
rata_r(1,2)=dumde/brl
rata_r(1,3)=duml/brl
rata_r(1,4)=dumb/brl
rata_r(1,5)=dumvmag/brl
rata_r(1,6)=dumamp/brl
rata_r(1,7)=dumper/brl
rata_r(1,8)=dumlksl/brl
rata_r(1,9)=dumpar/brl

// Mira
[bml kml]=size(data_myl) // data latih dari file angka (mira)
[bmhl kmhl]=size(data_mhl) // data latih dari file tipe (mira)

dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
dumlksl=0
dumpar=0

for r=1:1:bml
   dumraj=dumraj+data_myl(r,1);
   dumde=dumde+data_myl(r,2);
   duml=duml+data_myl(r,3);
   dumb=dumb+data_myl(r,4);
   dumvmag=dumvmag+data_myl(r,5);
   dumamp=dumamp+data_myl(r,6);
```

```
   dumper=dumper+data_myl(r,7);
   dumlksl=dumlksl+data_myl(r,8);
   dumpar=dumpar+data_myl(r,9);
end

rata_m(1,1)=dumraj/bml
rata_m(1,2)=dumde/bml
rata_m(1,3)=duml/bml
rata_m(1,4)=dumb/bml
rata_m(1,5)=dumvmag/bml
rata_m(1,6)=dumamp/bml
rata_m(1,7)=dumper/bml
rata_m(1,8)=dumlksl/bml
rata_m(1,9)=dumpar/bml

// Standar deviasi

// Cepheid

dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
dumlksl=0
dumpar=0

for r=1:1:bcl
   dumraj=dumraj+(data_cyl(r,1)-rata_c(1,1))^2;
   dumde=dumde+(data_cyl(r,2)-rata_c(1,2))^2;
   duml=duml+(data_cyl(r,3)-rata_c(1,3))^2;
   dumb=dumb+(data_cyl(r,4)-rata_c(1,4))^2;
   dumvmag=dumvmag+(data_cyl(r,5)-rata_c(1,5))^2;
   dumamp=dumamp+(data_cyl(r,6)-rata_c(1,6))^2;
   dumper=dumper+(data_cyl(r,7)-rata_c(1,7))^2;
   dumlksl=dumlksl+(data_cyl(r,8)-rata_c(1,8))^2;
   dumpar=dumpar+(data_cyl(r,9)-rata_c(1,9))^2;
end
std_c(1,1)=(dumraj/(bcl-1))^(0.5)
std_c(1,2)=(dumde/(bcl-1))^(0.5)
std_c(1,3)=(duml/(bcl-1))^(0.5)
std_c(1,4)=(dumb/(bcl-1))^(0.5)
std_c(1,5)=(dumvmag/(bcl-1))^(0.5)
std_c(1,6)=(dumamp/(bcl-1))^(0.5)
```

```
std_c(1,7)=(dumper/(bcl-1))^(0.5)
std_c(1,8)=(dumlksl/(bcl-1))^(0.5)
std_c(1,9)=(dumpar/(bcl-1))^(0.5)

// RR Lyrae
dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
dumlksl=0
dumpar=0

for r=1:1:brl
   dumraj=dumraj+(data_rryl(r,1)-rata_r(1,1))^2;
   dumde=dumde+(data_rryl(r,2)-rata_r(1,2))^2;
   duml=duml+(data_rryl(r,3)-rata_r(1,3))^2;
   dumb=dumb+(data_rryl(r,4)-rata_r(1,4))^2;
   dumvmag=dumvmag+(data_rryl(r,5)-rata_r(1,5))^2;
   dumamp=dumamp+(data_rryl(r,6)-rata_r(1,6))^2;
   dumper=dumper+(data_rryl(r,7)-rata_r(1,7))^2;
   dumlksl=dumlksl+(data_rryl(r,8)-rata_r(1,8))^2;
   dumpar=dumpar+(data_rryl(r,9)-rata_r(1,9))^2;
end
std_r(1,1)=(dumraj/(brl-1))^(0.5)
std_r(1,2)=(dumde/(brl-1))^(0.5)
std_r(1,3)=(duml/(brl-1))^(0.5)
std_r(1,4)=(dumb/(brl-1))^(0.5)
std_r(1,5)=(dumvmag/(brl-1))^(0.5)
std_r(1,6)=(dumamp/(brl-1))^(0.5)
std_r(1,7)=(dumper/(brl-1))^(0.5)
std_r(1,8)=(dumlksl/(brl-1))^(0.5)
std_r(1,9)=(dumpar/(brl-1))^(0.5)

// Mira
dumraj=0
dumde=0
duml=0
dumb=0
dumvmag=0
dumamp=0
dumper=0
dumlksl=0
dumpar=0
```

```
for r=1:1:bml
   dumraj=dumraj+(data_myl(r,1)-rata_m(1,1))^2;
   dumde=dumde+(data_myl(r,2)-rata_m(1,2))^2;
   duml=duml+(data_myl(r,3)-rata_m(1,3))^2;
   dumb=dumb+(data_myl(r,4)-rata_m(1,4))^2;
   dumvmag=dumvmag+(data_myl(r,5)-rata_m(1,5))^2;
   dumamp=dumamp+(data_myl(r,6)-rata_m(1,6))^2;
   dumper=dumper+(data_myl(r,7)-rata_m(1,7))^2;
   dumlksl=dumlksl+(data_myl(r,8)-rata_m(1,8))^2;
   dumpar=dumpar+(data_myl(r,9)-rata_m(1,9))^2;
end
std_m(1,1)=(dumraj/(bml-1))^(0.5)
std_m(1,2)=(dumde/(bml-1))^(0.5)
std_m(1,3)=(duml/(bml-1))^(0.5)
std_m(1,4)=(dumb/(bml-1))^(0.5)
std_m(1,5)=(dumvmag/(bml-1))^(0.5)
std_m(1,6)=(dumamp/(bml-1))^(0.5)
std_m(1,7)=(dumper/(bml-1))^(0.5)
std_m(1,8)=(dumlksl/(bml-1))^(0.5)
std_m(1,9)=(dumpar/(bml-1))^(0.5)

// Fungsi distribusi Gaussian

// Cepheid

for mk=1:1:ku
   for mb=1:1:bu
      pembilang= exp(-0.5*((yu(mb,mk)-rata_c(1,mk))/std_c(1,mk))^2);
      penyebut=std_c(1,mk)*sqrt(2*22/7);
      dist_c(mb,mk)=pembilang/penyebut;
   end
end

// RR Lyrae

for mk=1:1:ku
   for mb=1:1:bu
      pembilang= exp(-0.5*((yu(mb,mk)-rata_r(1,mk))/std_r(1,mk))^2);
      penyebut=std_r(1,mk)*sqrt(2*22/7);
      dist_r(mb,mk)=pembilang/penyebut;
   end
end

// Mira
```

```
for mk=1:1:ku
   for mb=1:1:bu
      pembilang= exp(-0.5*((yu(mb,mk)-rata_m(1,mk))/std_m(1,mk))^2);
      penyebut=std_m(1,mk)*sqrt(2*22/7);
      dist_m(mb,mk)=pembilang/penyebut;
   end
end

// Probabilitas setiap kelas

prob_c=0;
prob_r=0;
prob_m=0;

for mb=1:1:bl
 if hl(mb,1)== "CEPHEID" then prob_c=prob_c+1/bl end
 if hl(mb,1)== "RR LYRAE" then prob_r=prob_r+1/bl end
 if hl(mb,1)== "MIRA" then prob_m=prob_m+1/bl end
end

// Likelihood
for mb=1:1:bu

L(mb,1)=prob_c*dist_c(mb,1)*dist_c(mb,2)*dist_c(mb,3)*dist_c(mb,4)*dist_c(m
b,5)*dist_c(mb,6)*dist_c(mb,7)*dist_c(mb,8)*dist_c(mb,9)

L(mb,2)=prob_r*dist_r(mb,1)*dist_r(mb,2)*dist_r(mb,3)*dist_r(mb,4)*dist_r(mb,
5)*dist_r(mb,6)*dist_r(mb,7)*dist_r(mb,8)*dist_r(mb,9)

L(mb,3)=prob_m*dist_m(mb,1)*dist_m(mb,2)*dist_m(mb,3)*dist_m(mb,4)*dist
_m(mb,5)*dist_m(mb,6)*dist_m(mb,7)*dist_m(mb,8)*dist_m(mb,9)

   PAss(mb,1)=L(mb,1)/(L(mb,1)+L(mb,2)+L(mb,3));
   PAss(mb,2)=L(mb,2)/(L(mb,1)+L(mb,2)+L(mb,3));
   PAss(mb,3)=L(mb,3)/(L(mb,1)+L(mb,2)+L(mb,3));
end

// P Assignment
for mb=1:1:bu
   if PAss(mb,1) > PAss(mb,2)
      PAss(mb,4) = PAss(mb,1);
   end
   if PAss(mb,2) > PAss(mb,1)
      PAss(mb,4) = PAss(mb,2);
   end
   if PAss(mb,4) < PAss(mb,3)
```

```
        PAss(mb,4) = PAss(mb,3);
    end
    if PAss(mb,4)==PAss(mb,1)
        hu(mb,2)="CEPHEID";
    end
    if PAss(mb,4)==PAss(mb,2)
        hu(mb,2)="RR LYRAE";
    end
    if PAss(mb,4)==PAss(mb,3)
        hu(mb,2)="MIRA";
    end
end

// Melihat kesamaan kolom 1 dan kolom 2
for mb=1:1:bu
    if hu(mb,1) == hu(mb,2)
        JS(mb,1)=1;
    end
    if hu(mb,1) ~= hu(mb,2)
        JS(mb,1)=0;
    end
end

// Menghitung persentase keakuratannya
S=0
for r=1:1:bu
    S=S+(JS(r,1));
end
ps = S/bu;

// Cepheid
for mb=1:1:bu
    JC(mb,1)=0;
    if hu(mb,1) == "CEPHEID"
        if hu(mb,2) == "CEPHEID"
            JC(mb,1)=1;
        end
        if hu(mb,2) == "RR LYRAE"
            JC(mb,1)=2;
        end
        if hu(mb,2) == "MIRA"
            JC(mb,1)=3;
        end
    end
end
```

```
// Menghitung hasil klasifikasi Cepheid

for mb=1:1:bu
   count_cc = sum(JC == 1);
   count_cr = sum(JC == 2);
   count_cm = sum(JC == 3);
end

// RR Lyrae
for mb=1:1:bu
   JR(mb,1)=0;
   if hu(mb,1) == "RR LYRAE"
      if hu(mb,2) == "CEPHEID"
         JR(mb,1)=1;
      end
      if hu(mb,2) == "RR LYRAE"
         JR(mb,1)=2;
      end
      if hu(mb,2) == "MIRA"
         JR(mb,1)=3;
      end
   end
end

// Menghitung hasil klasifikasi RR Lyrae

for mb=1:1:bu
   count_rc = sum(JR == 1);
   count_rr = sum(JR == 2);
   count_rm = sum(JR == 3);
end

// Mira
for mb=1:1:bu
   JM(mb,1)=0;
   if hu(mb,1) == "MIRA"
      if hu(mb,2) == "CEPHEID"
         JM(mb,1)=1;
      end
      if hu(mb,2) == "RR LYRAE"
         JM(mb,1)=2;
      end
      if hu(mb,2) == "MIRA"
         JM(mb,1)=3;
      end
   end
```

```
end

// Menghitung hasil klasifikasi Mira

for mb=1:1:bu
   count_mc = sum(JM == 1);
   count_mr = sum(JM == 2);
   count_mm = sum(JM == 3);
end

// Menghitung Confusion Matrix

// Cepheid
TP_c = count_cc;
FP_c = count_rc + count_mc;
FN_c = count_cr + count_cm;

presisi_c = TP_c / (TP_c + FP_c);
recall_c = TP_c / (TP_c + FN_c);
f1_score_c = (2 * TP_c) / ((2 * TP_c) + FP_c + FN_c);

// RR Lyrae
TP_r = count_rr;
FP_r = count_cr + count_mr;
FN_r = count_rc + count_rm;

presisi_r = TP_r / (TP_r + FP_r);
recall_r = TP_r / (TP_r + FN_r);
f1_score_r = (2 * TP_r) / ((2 * TP_r) + FP_r + FN_r);

// Mira
TP_m = count_mm;
FP_m = count_cm + count_rm;
FN_m = count_mc + count_mr;

presisi_m = TP_m / (TP_m + FP_m);
recall_m = TP_m / (TP_m + FN_m);
f1_score_m = (2 * TP_m) / ((2 * TP_m) + FP_m + FN_m);
```