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%Homework 5 exercise 1 %involved m-files: none close all;clear all; %==values== x1=[-2.063 ;
-1.316 ; -1.102 ; -0.471 ; -0.101 ; 0.257 ; 0.882 ; 1.687 ; 2.014]; y1=[3.858 ; 2.369 ; 1.091 ; 0.209
; -0.214 ; 0.139 ; 0.771 ; 2.361 ; 3.857]; dy=[0.176 ; 0.560 ; 0.085 ; 0.073 ; 0.165 ; 0.073 ; 0.052 ;
0.281 ; 0.196]; %==definitions== A=zeros(9,2); A(:,1)=x1; A(:,2)=zeros(9,1)+1; tau=1e-15;
%matlab svd decomposition of A [U,S,V]=svd(A); U1=U; S1=S; V1=V; %==pseudoinverse
method== for i=1:length(A(1,:)) if S(i,i)>tau S(i,i)=1/S(i,i); else S(i,i)=0; end end Up=U';
Ap=V*S*Up; %==find coefficients for the fit== xh=Ap*y1; xh1=xh; xx1=[-2:0.1:2];
yy1=xh(1)*xx1+xh(2); %==second equation== A=zeros(9,3); A(:,3)=zeros(9,1)+1; A(:,2)=x1;
A(:,1)=x1.^2; [U,S,V]=svd(A); U2=U; S2=S; V2=V; for i=1:length(A(1,:)) if S(i,i)>tau S(i,i)=1/S(i,i);
else S(i,i)=0; end end Up=U'; Ap=V*S*Up; xh=Ap*y1; xh2=xh; xx2=[-2:0.1:2];
yy2=xh(1)*xx2.^2+xh(2)*xx2+xh(3); %==third equation== A=zeros(9,3); A(:,3)=zeros(9,1)+1;
A(:,2)=exp(-x1); A(:,1)=exp(x1); [U,S,V]=svd(A); U3=U; S3=S; V3=V; for i=1:length(A(1,:)) if
S(i,i)>tau S(i,i)=1/S(i,i); else S(i,i)=0; end end Up=U'; Ap=V*S*Up; xh=Ap*y1; xh3=xh;
xx3=[-2:0.1:2]; yy3=xh(1)*exp(xx3)+xh(2)*exp(-xx3)+xh(3); %plotting the results figure
errorbar(x1,y1,dy,'mo') hold on; plot(xx1,yy1,'b'); hold on; plot(xx3,yy3,'k'); hold on;
plot(xx2,yy2,'r'); legend('original set','y=a+bx','y=a+bx+cx^2','y=a+be^{-x}+ce^x'); grid('on');
%=====Chi square test===== %1 ) chi goodness and reduced chi square:
chi_linear=0; chi_square=0; chi_exponential=0; for i=1:length(x1)
chi_linear=chi_linear+((y1(i)-(xh1(1)*x1(i)+xh1(2)))/dy(i)).^2; end for i=1:length(x1)
chi_square=chi_square+((y1(i)-(xh2(1)*x1(i)^2+xh2(2)*x1(i)+xh2(3)))/dy(i)).^2; end for
i=1:length(x1)
chi_exponential=chi_exponential+((y1(i)-(xh3(1)*exp(x1(i))+xh3(2)*exp(-x1(i))+xh3(3)))/dy(i)).^2;
end %goodness chi_linear chi_square chi_exponential %reduced chi_linear/7 chi_square/6
chi_exponential/6 %square fit is best fit !! %2) covariance matrix W1=diag(1./diag(S1));
covmat1=V1*W1.^2*V1' W2=diag(1./diag(S2)); covmat2=V2*W2.^2*V2' W3=diag(1./diag(S3));
covmat3=V3*W3.^2*V3' if 1 %=====WITH
WEIGHT ON THE %VALUES===== %==values== x1=[-2.063 ; -1.316 ; -1.102 ; -0.471 ;
-0.101 ; 0.257 ; 0.882 ; 1.687 ; 2.014]; y1=[3.858 ; 2.369 ; 1.091 ; 0.209 ; -0.214 ; 0.139 ; 0.771 ;
2.361 ; 3.857]; dy=[0.176 ; 0.560 ; 0.085 ; 0.073 ; 0.165 ; 0.073 ; 0.052 ; 0.281 ; 0.196];
%==definitions== A=zeros(9,2); A(:,1)=x1./dy; A(:,2)=(zeros(9,1)+1)./dy; tau=1e-15; %matlab
svd decomposition of A [U,S,V]=svd(A); U1=U; S1=S; V1=V; %==pseudoinverse method== for
i=1:length(A(1,:)) if S(i,i)>tau S(i,i)=1/S(i,i); else S(i,i)=0; end end Up=U'; Ap=V*S*Up; %==find
coefficients for the fit== xh=Ap*(y1./dy); xh1=xh; xx1=[-2:0.1:2]; yy1=xh(1)*xx1+xh(2);
%=====same thing, second equation== %==second equation== A=zeros(9,3);
A(:,3)=(zeros(9,1)+1)./dy; A(:,2)=x1./dy; A(:,1)=x1.^2./dy; [U,S,V]=svd(A); U2=U; S2=S; V2=V;
for i=1:length(A(1,:)) if S(i,i)>tau S(i,i)=1/S(i,i); else S(i,i)=0; end end Up=U'; Ap=V*S*Up;
xh=Ap*(y1./dy); xh2=xh; xx2=[-2:0.1:2]; yy2=xh(1)*xx2.^2+xh(2)*xx2+xh(3); %same thing, third
equation %==third equation== A=zeros(9,3); A(:,3)=(zeros(9,1)+1)./dy; A(:,2)=exp(-x1)./dy;
A(:,1)=exp(x1)./dy; [U,S,V]=svd(A); U3=U; S3=S; V3=V; for i=1:length(A(1,:)) if S(i,i)>tau
S(i,i)=1/S(i,i); else S(i,i)=0; end end Up=U'; Ap=V*S*Up; xh=Ap*(y1./dy); xh3=xh; xx3=[-2:0.1:2];
yy3=xh(1)*exp(xx3)+xh(2)*exp(-xx3)+xh(3); %plotting the results with weighted values figure
errorbar(x1,y1,dy,'mo') hold on; plot(xx1,yy1,'b'); hold on; plot(xx3,yy3,'k'); hold on;
plot(xx2,yy2,'r'); legend('original set','y=a+bx','y=a+bx+cx^2','y=a+be^{-x}+ce^x'); grid('on');
%=====Chi square test===== %1 ) chi goodness and reduced chi square:
chiw_linear=0; chiw_square=0; chiw_exponential=0; for i=1:length(x1)
chiw_linear=chiw_linear+((y1(i)-(xh1(1)*x1(i)+xh1(2)))/dy(i)).^2; end for i=1:length(x1)
chiw_square=chiw_square+((y1(i)-(xh2(1)*x1(i)^2+xh2(2)*x1(i)+xh2(3)))/dy(i)).^2; end for
i=1:length(x1)

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chiw_exponential=chiw_exponential+((y1(i)-(xh3(1)*exp(x1(i))+xh3(2)*exp(-x1(i))+xh3(3)))/dy(i)).
^2; end %goodness chiw_linear chiw_square chiw_exponential %reduced chiw_linear/7
chiw_square/6 chiw_exponential/6 %square fit is best fit !! %2) covariance matrix
W1w=diag(1./diag(S1)); covmat1w=V1*W1.^2*V1' W2w=diag(1./diag(S2));
covmat2w=V2*W2.^2*V2' W3w=diag(1./diag(S3)); covmat3w=V3*W3.^2*V3' end

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