%Denys Fedorchuk

%Professor Henrich

%CMSC284

%MATLAB assignment 5

%=========================Problem1==========================%

A = pascal(4)

% a) Show that column of a for a basis for R^4. If a matrix

% invertible, then it forms a basis of R^n. In our case

% matrix is in R^4 so if matrix is invertible then it forms

% a basis in R^4

det(A)

ans =

1

% determinant is not zero so matrix is invertible

%b) Use the Gram-Schmidt process (as described in the overview) to

% find a matrix U whose columns form an orthonormal basis for ℝ4

U = A(:,1)/norm(A(:, 1));

for k=2:4

z = A(:,k)-U\*(U'\*A(:,k));

u = z/norm(z); U=[U,u];

end

>> U

U =

0.5000 -0.6708 0.5000 -0.2236

0.5000 -0.2236 -0.5000 0.6708

0.5000 0.2236 -0.5000 -0.6708

0.5000 0.6708 0.5000 0.2236

%c) From your result in part (b), find a QR factorization of A QT\*A = I\*R

Q = U

Q =

0.5000 -0.6708 0.5000 -0.2236

0.5000 -0.2236 -0.5000 0.6708

0.5000 0.2236 -0.5000 -0.6708

0.5000 0.6708 0.5000 0.2236

>> QT = transpose(Q)

QT =

0.5000 0.5000 0.5000 0.5000

-0.6708 -0.2236 0.2236 0.6708

0.5000 -0.5000 -0.5000 0.5000

-0.2236 0.6708 -0.6708 0.2236

>> R = QT\*A\*eye(4)

R =

2.0000 5.0000 10.0000 17.5000

0 2.2361 6.7082 14.0872

-0.0000 -0.0000 1.0000 3.5000

0.0000 0.0000 0.0000 0.2236

%d) use qr command and compare the results

[Q, R] = qr(A)

Q =

-0.5000 0.6708 0.5000 0.2236

-0.5000 0.2236 -0.5000 -0.6708

-0.5000 -0.2236 -0.5000 0.6708

-0.5000 -0.6708 0.5000 -0.2236

R =

-2.0000 -5.0000 -10.0000 -17.5000

0 -2.2361 -6.7082 -14.0872

0 0 1.0000 3.5000

0 0 0 -0.2236

%Q and R values are the same but the signs are different in both matrices

%e)Use the orthogonal matrix command orth(A) to produce an

%orthogonal basis for ℝ4

orth(A)

ans =

-0.0602 -0.5304 0.7873 -0.3087

-0.2012 -0.6403 -0.1632 0.7231

-0.4581 -0.3918 -0.5321 -0.5946

-0.8638 0.3939 0.2654 0.1684

%f) Check if vectors of basis are orthonormal. To be orthonormal

% dot product of all vectors in the matrix must = 0. Use 2 nested

% for loops to check all the vectors

for i = 1:4

for j = i+1:4

disp(round(dot(Q(:,i), Q(:,j))));

end

end

0

0

0

0

0

0

% dot product of every possible combination of vectors = 0 so matrix

% is orthonormal

%============================Problem2================================%

X = [0 0 0;

2 4 8;

4 4^2 4^3;

6 6^2 6^3;

8 8^2 8^3;

10 10^2 10^3;

12 12^2 12^3]

X =

0 0 0

2 4 8

4 16 64

6 36 216

8 64 512

10 100 1000

12 144 1728

>> Y = [0; 29.9; 104.7; 222.0; 380.4; 571.7; 809.2]

Y =

0

29.9000

104.7000

222.0000

380.4000

571.7000

809.2000

beta = X'\*X\X'\*Y

beta =

4.2611

5.6236

-0.0305