**Acheev Bhagat**

**MATLAB 3**

**Problem 1**

AREF =

1.0000 0 0 -0.0105 0.0105

0 1.0000 0 2.0526 -1.0526

0 0 1.0000 2.8105 -1.8105

0 0 0 0 0

w is in the column space of A because AREF is consistent where AREF is the reduced echelon matrix built from A augmented by w. w is not in the null space of A because ANUL is not the zero vector where ANUL is A multiplied by w.

**Problem 2**

A =

191319 120919 411515 19451 216746 -165597 339262 340134

423715 166831 628660 557032 -60931 241318 105547 334183

-1163317 -821749 -1603066 -1180627 -263162 -902080 -860482 -1004395

-417088 -164248 -727651 -405012 -84818 -5861 -271346 -464635

238633 137581 452209 123258 167483 -75715 301553 339370

392109 413485 436751 342693 173846 516251 415866 299544

ARANK =

3

ANUL =

-0.6711 0.5627 0.1069 0.2326 -0.0492

0.6318 0.5444 -0.1161 0.1749 -0.1767

0.0674 -0.3308 -0.4223 0.0674 -0.4531

0.2503 -0.0221 0.5958 -0.3681 0.0187

-0.1777 0.1203 -0.0285 -0.8076 -0.2119

-0.1951 -0.3214 -0.3236 -0.0654 0.1343

-0.0363 -0.3956 0.5375 0.3299 0.0027

0.1114 0.0528 -0.2176 -0.0999 0.8353

ANULRANK =

5

AxANUL =

6.1863e-10

ANUL vectors are indeed in the null space because when multiplied back with A the results are 0. In addition, they are linearly independent because their rank is 5.

**Problem 3**

F =

8 4 -1 6 -1

9 5 -4 8 4

-3 1 -9 4 11

-6 -4 6 -7 -8

0 4 -7 10 -7

FREF =

1.0000 0 0 -0.5000 3.0000

0 1.0000 0 2.5000 -7.0000

0 0 1.0000 0 -3.0000

0 0 0 0 0

0 0 0 0 0

The first three columns are F are independent, so they would form the basis of the space spanned by the vectors.

**Problem 4**

A =

[]

A =

1.0000 0.8415 -0.4161 0.4546

A =

1.0000 0.8415 -0.4161 0.4546

2.0000 0.9093 -0.6536 -0.3784

A =

1.0000 0.8415 -0.4161 0.4546

2.0000 0.9093 -0.6536 -0.3784

3.0000 0.1411 0.9602 -0.1397

A =

1.0000 0.8415 -0.4161 0.4546

2.0000 0.9093 -0.6536 -0.3784

3.0000 0.1411 0.9602 -0.1397

4.0000 -0.7568 -0.1455 0.4947

detA =

-6.0242

The set of functions is linearly independent because its determinant is not 0.

**Problem 5**

rankA =

3

The coefficients of the polynomials don't result in a rank of 4 so the polynomials don't form the basis of P3.

**Problem 6**

ans =

0.5213 0.2095 0.3998

0.0626 0.3744 0.0626

0.4161 0.4161 0.5377

ans =

0.4512 0.3540 0.4365

0.0821 0.1793 0.0821

0.4667 0.4667 0.4815

ans =

0.4390 0.4087 0.4372

0.0882 0.1185 0.0882

0.4728 0.4728 0.4746

ans =

0.4364 0.4269 0.4362

0.0900 0.0995 0.0900

0.4736 0.4736 0.4738

ans =

0.4357 0.4327 0.4357

0.0906 0.0936 0.0906

0.4737 0.4737 0.4737

ans =

0.4355 0.4346 0.4355

0.0908 0.0917 0.0908

0.4737 0.4737 0.4737

ans =

0.4354 0.4351 0.4354

0.0909 0.0912 0.0909

0.4737 0.4737 0.4737

ans =

0.4354 0.4353 0.4354

0.0909 0.0910 0.0909

0.4737 0.4737 0.4737

ans =

0.4354 0.4354 0.4354

0.0909 0.0909 0.0909

0.4737 0.4737 0.4737

ans =

0.4354 0.4354 0.4354

0.0909 0.0909 0.0909

0.4737 0.4737 0.4737

Every time Q is raised to the power of 10, each row approaches a different value. Row 1 approaches 0.4354, Row 2 approached 0.0909, and Row 3 approaches 0.4737. Therefore, as *k* approaches infinity each row of the system will approach 0.4354, 0.0909, and 0.4737. The steady-state vector *p* for this system is

P =

0.6701

0.1399

0.7290