**In-Lab Group Activity for Week 5: Row, Column and Null Space**

**Name: Cole Bardin**

***first     last***

**Problem 1: Row, Column and Null Space**

The coefficient matrix *A* and its reduced form *B* are shown below.

**a.** The transformation maps the vector in to the vector: ii.

**i.** **ii.** **iii.** **iv.**

**b.** Fill out the following table of properties of the matrix *A*. **Rank** is always the number of pivots.

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Dimension of**  **Row Space** | **Dimension of Column Space** | **Dimension of**  **Null Space** |
| **2** | **R4** | **R3** | **2** |

**c.** Find a basis for the **column space** of *A*. It's the ramp or plane.

**Required Answer Method:** Choose the column(s) from *A* that have pivots in *B*.

**d.** Do the pivot columns of *B* also form a basis for the column space of *A*? **Yes** **No**

**e.** Find a basis for the **row space** of *A*. Must give rows!

**Answer Method:** Choose the non-zero rows from *B*.

**f.** Write out the **null space** for the homogenous equation in vector parametric form:

**Problem 2: Row, Column and Null Space**

The coefficient matrix *A* and its reduced form *B* are shown below. Below, *R* combines all the row-reducing operations into a single, square invertible matrix.

**a.** One of these is **not** the same for the matrices *A* and *B*.

**i.** Null space **ii.** Column space **iii.** Row space

**b.** Fill out the following table of properties of the matrix *A*. **Rank** is always the number of pivots.

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Dimension of**  **Row Space** | **Dimension of Column Space** | **Dimension of**  **Null Space** |
| **1** | **3** | **3** | **2** |

**c.** Find a basis for the **column space** of *A*. It's the **line**: .

**Required Answer Method:** Choose the column(s) from *A* that have pivots in *B*.

**d.** Do the pivot columns of *B* also form a basis for the column space of *A*? **Yes** **No**

**e.** Find a basis for the **row space** of *A*. Must give row(s)!

**Answer Method:** Choose the non-zero rows from *B*.

**f.** Write out the null space for the homogenous equation in vector parametric form:

**g.** Find a **particular** solution to the nonhomogeneous equation where .

**i. ii. iii. iv. v.**

**Problem 3: Match each matrix with its determinant!**

**Hints:**  Subtract R1 from R2 & R4 for D. Use Cofactor expansion for E.

Do not use MATLAB except to check your hand calculations.

**Triangular matrix rule!**

**Two-arrow rule**

**Identical rows!**

**Cofactor expansion!**

**Use the EROs suggested above.**

**a.** Each of these determinants is a perfect square or the negative of a square.

**i.** This matrix has determinant equal to +4. *A B C D E*

**ii.** This matrix has determinant equal to 0. *A B C D E*

**iii.** This matrix has determinant equal to –9. *A B C D E*

**iv.** This matrix has determinant equal to +16. *A B C D E*

**v.** This matrix has determinant equal to +25. *A B C D E*

**b.** Find the determinant of the matrix *A*. We are given that *A* can be row-reduced to the matrix using the row operations itemized below. Starting with *A*:

**Fill in the missing constant after each step.**

**-1**

**i.** Swap the first two rows and name the result .

**-1**

**ii.** Subtract row 1 of from its second row and name the result

**-1**

**iii.** Subtract twice row 1 of from its last row and name the result .

**-1/5**

**iv.** Divide row 5 of by 5 and name the result *B*.

**5**

**v.** Give the determinant of *B* above.

**­-25**

**vi.** Give the determinant of *A*.

If you want to double check, the mystery matrix *A* is revealed on the next page as well as the row operations that result in *B*.

Mystery Matrix