MATH 152 MATLAB Computer Lab 1

Vectors and Geometry

Instructions

- Make sure to save the variable for each exercise with the correct variable name
- Save all variables to a file called `lab1.mat` and submit the file to Canvas
- Attend your scheduled lab section and visit MATLAB TA office hours for extra help

Exercise 1

(a) Assign your student number to the variable `Ex1Anum`. (Note: we are asking for a number like `87654321` and **not** text with quotation marks as in `"87654321"`.)

(b) Enter the first 3 digits of your student number as a (row) vector and save the result as `Ex1Bvec`. For example, if your student number is `87654321` then we are asking for the vector $(8, 7, 6)$.

(c) Compute the length of the vector in (b) and save the result as `Ex1Cnum`.

(d) Enter the first 3 digits of your student number as a vector $\mathbf{v}$ and enter the last 3 digits of your student number as a vector $\mathbf{w}$. Compute the projection of $\mathbf{v}$ onto $\mathbf{w}$ and save the result as `Ex1Dvec`. For example, if your student number is `87654321` then we are asking for the projection of $(8, 7, 6)$ onto $(3, 2, 1)$.

Exercise 2

The centroid of a triangle is the arithmetic mean of the vertices. In other words, if A, B and C are the vertices of a triangle then the centroid is given by

$$\frac{1}{3}(A + B + C)$$

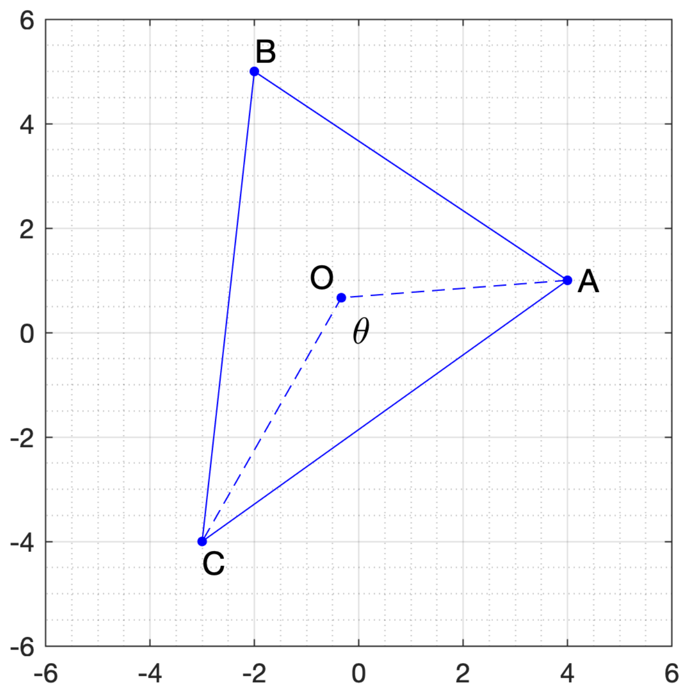
(a) Compute the centroid O of the triangle with vertices $A = (4, 1)$, $B = (-2, 5)$ and $C = (-3, -4)$ (see figure below) and save the result as `Ex2Avec`.

(b) Find the vector from O to A and save the result as `Ex2Bvec`.

(c) Find the vector from O to C and save the result as `Ex2Cvec`.

(d) Find the angle $\angle AOC$ and save the result as `Ex2Dnum`. Use the dot product formula

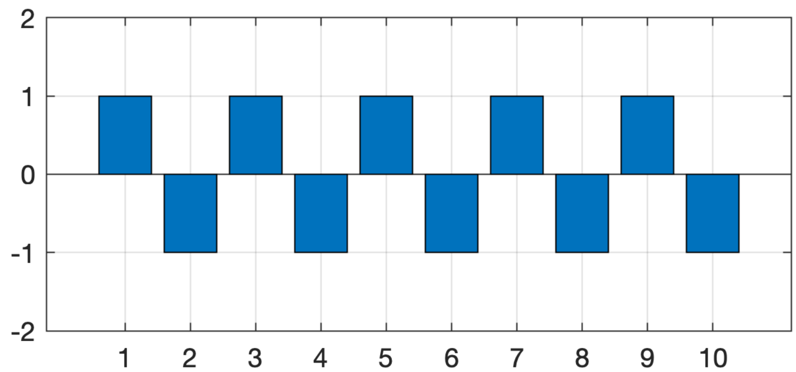
$$\mathbf{v} \cdot \mathbf{w} = \|\mathbf{v}\|\|\mathbf{w}\| \cos\theta$$



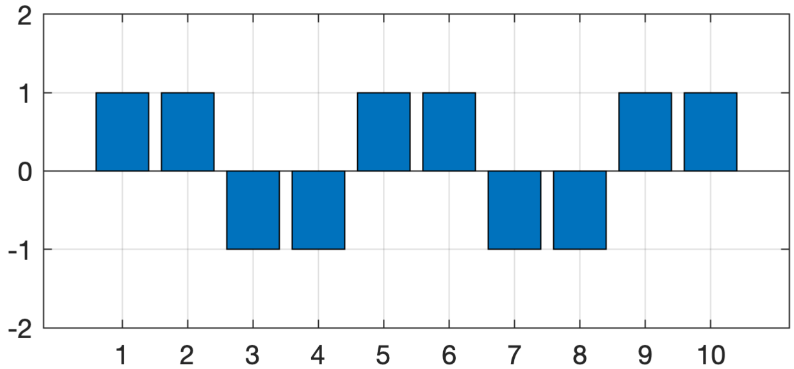
Exercise 3

We can visualize the geometry of vectors in 2D and 3D space as arrows but this is not possible in higher dimensions. Instead we can visualize vectors in higher dimensions using bar plots where the x-axis represents the index and the y-axis is the value of each entry. For example:

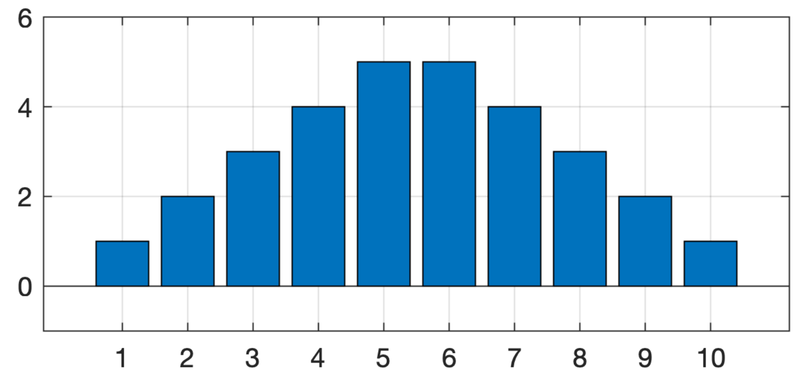
```
>> v1 = [+1 -1 +1 -1 +1 -1 +1 -1 +1 -1];
>> bar(v1), grid on, ylim([-2 +2])
```



```
>> v2 = [+1 +1 -1 -1 +1 +1 -1 -1 +1 +1];
>> bar(v2), grid on, ylim([-2 +2])
```




```
>> w = [1 2 3 4 5 5 4 3 2 1];
>> bar(w), grid on, ylim([-1 +6])
```



(a) Compute the projection of `w` onto `v1` and save the result as `Ex3Avec`.

(b) Compute the projection of `w` onto `v2` and save the result as `Ex3Bvec`.

(c) Is the vector `w` perpendicular to `v1`? Save your response as `Ex3Ctext = "yes"` or `Ex3Ctext = "no"`.

(d) Is the vector `w` perpendicular to `v2`? Save your response as `Ex3Dtext = "yes"` or `Ex3Dtext = "no"`.