MAT 226B Large Scale Matrix Computation
Homework 4

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Problem 1:

(a)

Problem 2:

The function `arnoldi_process` in `problem_2.m` implements Arnoldi process. It takes matrix A, initial r vector, and `KMAX` value and outputs matrices H_k and V_K. We test the function with $k = 5, 10,$ and 20. Table 1 shows the eignevalues of H_k for different values of k. Table 2 shows the eignevalues of A. To compare between the eigenvalue of H_{20} and A's eigenvalues, we computed $\| A\_eig - H_{20}\_eig \| = 2.022960706546113e{-}14$

K	Eigenvalues
5	$-1.667643118967301e{+}00 + 3.322698092379202e{+}00i$
	$1.122189729586331e{+}00 + -2.935868201795706e{+}00i$
	$-2.454291098365838e{+}00 + -1.034091783975195e{-}01i$
	$1.901983203411739e{+}00 + 2.938354695246812e{-}02i$
	$-1.488418331702275e{-}01 + 4.856460403443859e{-}03i$
10	$-1.284055777449226e{+}00 + +3.812474971159054e{+}00i$
	$2.481430445455568e{-}01 + -3.792088063628674e{+}00i$
	$2.484678533435320e{+}00 + -2.158804713951516e{+}00i$
	$-9.594670448581000e{-}01 + -2.797385858005139e{+}00i$
	$-1.865849533089461e{+}00 + +2.203044871147163e{+}00i$
	$-2.769085996727914e{+}00 + -4.783604953147819e{-}01i$
20	$-1.246365732148964e{+}00 + +3.879484437687161e{+}00i$
	$1.251730623491198e{-}01 + -3.705917327586333e{+}00i$
	$2.594180629560022e{+}00 + -2.284902242884260e{+}00i$
	$-1.983514535906369e{+}00 + +2.443522984313272e{+}00i$
	$3.000394334727364e{+}00 + -9.028020730501802e{-}01i$
	$-8.152087361523789e{-}01 + -2.850024263184166e{+}00i$

Figure 1: H_k Eigenvalues

Eigenvalues
$-1.246365732148965e{+}00 + +3.879484437687162e{+}00i$
$1.251730623491239e{-}01 + -3.705917327586323e{+}00i$
$2.594180629560029e{+}00 + -2.284902242884256e{+}00i$
$-1.983514535906377e{+}00 + +2.443522984313265e{+}00i$
$3.000394334727376e{+}00 + -9.028020730501798e{-}01i$
$-8.152087361523785e{-}01 + -2.850024263184167e{+}00i$

Figure 2: A Eigenvalues

Problem 3:

(a)

Problem 4:

(a)