Spring 2017

MA 262 - EXAM 2

GREEN - Test Version 01

Instructions

1. Fill in your scantron with your `NAME, PUID, Section Number` (4 digits), and the correct `Test Version` (GREEN is 01).
2. This exam contains 10 problems worth 9 points each and 2 problems worth 5 points each, for a total of 100 points.
3. Do all your work only in the spaces provided or on the backside of the pages. Show your work.
4. Mark your answers clearly on your scantron. In addition, also **CIRCLE** your answer choice for each problem in this exam booklet in case your scantron is lost.
5. NO books, notes, calculators, phones, or cameras are allowed on this exam. Turn off and put away all electronic devices.

Academic Dishonesty

- *Students taking this exam are not allowed to seek or obtain any kind of help from anyone to answer questions on this exam. If you have questions, consult only your instructor.*
- *You are not allowed to look at the exam of another student. You may not compare answers with anyone else or consult another student until after you have finished your exam, handed it in to your instructor and left the room.*
- *You may not consult notes, books, calculators, phones, or cameras until after you have finished your exam, handed it in to your instructor and left the room.*
- *Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for academic dishonesty can be very severe. All cases of academic dishonesty will be reported to the Office of the Dean of Students.*

I have read and understand the above statements regarding academic dishonesty:

STUDENT NAME ______________________________

STUDENT PUID # ______________________________

STUDENT SIGNATURE ______________________________

SECTION #______________ **Recitation INSTRUCTOR** ______________

Sect #	Time	Recitation Instructor
0153	8:30am	Sokurski
0171	9:30am	Sokurski
0260	9:30am	Cooper
0284	10:30am	Cooper
0306	4:30pm	Zhang
0339	3:30pm	Zhang
0420	11:30am	Ponce
0464	12:30pm	Ponce

Sect #	Time	Recitation Instructor
0525	3:30pm	Parab
0570	4:30pm	Parab
0612	2:30pm	Liu
0636	1:30pm	Liu
0707	1:30pm	Solapurkar
0721	2:30pm	Solapurkar

1. Which of the following sets are *subspaces* ?

(i) $\{(x, y, z) \in \mathbb{R}^3 : \ 3x + 2y - z = 1\}$

(ii) $\left\{A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} : \ a + d = 0\right\}$

(iii) $\{y \in C^2(-1, 1) : \ y'' - y' - 2y = 0\}$

(iv) $\{(x, y) \in \mathbb{R}^2 : \ x \geq 0, \ y \geq 0\}$

A. (ii) and (iii)

B. (ii), (iii) and (iv)

C. (i) and (iii)

D. (iii) and (iv)

E. (i) and (ii)

2. The values of k for which the polynomials $\left\{(x^2 - kx), \ (x^2 - x + 1), \ (x^2 - x - 1)\right\}$ are linearly *dependent* are

A. $k = -1$ only

B. $k = 1$ only

C. $k = 1, \ -1$

D. All values of k

E. No values of k

3. Given that $A = \begin{bmatrix} 2 & -2 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 2 & 0 \\ 2 & 2 & 4 & 0 \\ 3 & -1 & 2 & 2 \end{bmatrix}$, the reduced row echelon form of A is $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$.

Which of the following sets form a basis for the column space of A ?

A. $\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \right\}$

B. $\left\{ \begin{bmatrix} 2 \\ 0 \\ 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} -2 \\ 0 \\ 1 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 2 \\ 4 \\ 2 \end{bmatrix} \right\}$

C. $\left\{ \begin{bmatrix} 2 \\ 0 \\ 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} -2 \\ 0 \\ 1 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \\ 2 \end{bmatrix} \right\}$

D. $\left\{ \begin{bmatrix} -2 \\ 0 \\ 1 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \\ 2 \end{bmatrix} \right\}$

E. $\left\{ \begin{bmatrix} 0 \\ 0 \\ 2 \\ 4 \\ 2 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \\ 2 \end{bmatrix} \right\}$

4. Let S be the subspace of M_{22} spanned by $\left\{ \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}, \begin{bmatrix} 2 & 5 \\ 6 & 1 \end{bmatrix}, \begin{bmatrix} 2 & 4 \\ 7 & 2 \end{bmatrix}, \begin{bmatrix} 1 & 3 \\ 0 & 0 \end{bmatrix} \right\}$.

The dimension of the subspace S is

A. 0

B. 2

C. 4

D. 3

E. 1

5. Let $S = \left\{ (x^2 + 2x - 2),\ (x^2 - 2x - 1),\ (-4x + 1) \right\}$ be a subset of $\mathcal{P}_2$.

Which of the statement(s) below is/are **TRUE** ?

(I) S is a linearly independent set.

(II) A basis for span S is $\left\{ (x^2 - 2x - 1),\ (-4x + 1) \right\}$.

(III) If $W = \text{span } S$, then $\dim(W) = 3$.

A. **(II)** only

B. **(I)** and **(III)**

C. **(I)**, **(II)**, and **(III)**

6. Which of the following sets is a basis for $\mathbb{R}^3$?

A. $\left\{ \begin{bmatrix} 0 \\ 0 \\ -2 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \right\}$

B. $\left\{ \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}, \begin{bmatrix} 5 \\ 6 \\ 2 \end{bmatrix} \right\}$

C. $\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \right\}$

D. $\left\{ \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix} \right\}$

E. $\left\{ \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} \right\}$

7. Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be the linear transformation for which

$$T(1,1) = (1,2,3) \quad \text{and} \quad T(1,3) = (3,2,1),$$

then $T(1,\ 5) =$

A. $(5,-1,2)$

B. $(2,7,5)$

C. $(5,2,8)$

D. $(1,5,-1)$

E. $(5,2,-1)$

8. If $T : \mathbb{R}^5 \to \mathbb{R}^3$ is the linear transformation given by $T(\mathbf{x}) = A\mathbf{x}$, where

$$A = \begin{bmatrix} 1 & 0 & 4 & -1 & 2 \\ 2 & 0 & 8 & -2 & 4 \\ 1 & -2 & -3 & 1 & 5 \end{bmatrix},$$

then the dimension of $\mathsf{Rng}(T)$ is :

A. 0

B. 2

C. 4

D. 3

E. 1

9. Let $T : \mathbb{R}^6 \to \mathbb{R}^4$ be the linear transformation given by $T(\mathbf{x}) = A\mathbf{x}$, where

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 3 & 5 & 7 & 9 & 11 \\ 2 & 5 & 8 & 11 & 14 & 17 \\ 0 & 1 & 2 & 3 & 4 & 5 \end{bmatrix},$$

then the dimension of $\mathsf{Ker}(T)$ is :

A. 1

B. 3

C. 5

D. 4

E. 2

10. Find a basis for the kernel of the linear transformation $T : C^2(\mathbb{R}) \to C(\mathbb{R})$ given by

$$T(y) = y'' + 2y' + 2y$$

A. $\{e^{-x}\cos x,\ e^{-x}\sin x\}$

B. $\{e^{-x}\cos 2x,\ e^{-x}\sin 2x\}$

C. $\{e^{x}\cos x,\ e^{x}\sin x\}$

D. $\{e^{x}\cos 2x,\ e^{x}\sin 2x\}$

E. $\{e^{x},\ xe^{x}\}$

11. Which of the following statement(s) is/are **TRUE** ?

(i) The largest eigenvalue of the matrix $\begin{bmatrix} 3 & 0 & 0 \\ 3 & 1 & 1 \\ 3 & 3 & 3 \end{bmatrix}$ is 4.

(ii) If $\mathbf{v}$ is an eigenvector of the matrix A, then $\frac{1}{2}\mathbf{v}$ is also an eigenvector of A.

(iii) If L is a linear differential operator with $Ly_1 = F(x)$ and $Ly_2 = F(x)$, then $L(y_1 + y_2) = F(x)$.

A. Only **(i)**

B. Only **(ii)** and **(iii)**

C. Only **(i)** and **(ii)**

12. Find the general solution to the differential equation

$$D^3\,(D^2+2D+1)y = 0\,.$$

A. $y = C_1x + C_2x^2 + C_3x^3 + C_4e^{-x} + C_5xe^{-x}$

B. $y = C_1 + C_2x + C_3x^2 + C_4e^{-x} + C_5xe^{-x}$

C. $y = C_1 + C_2x + C_3x^2 + C_4xe^{-x} + C_5x^2e^{-x}$

D. $y = C_1 + C_2 + C_3 + C_4e^{-x} + C_5e^{-x}$

E. $y = C_1 + C_2x + C_3x^2 + C_4\cos x + C_5\sin x$