

**CISS380: Computer Graphics**  
**Quiz q1105**

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Open `main.tex` and enter answers (look for `answercode`, `answerbox`, `answerlong`). Turn the page for detailed instructions. To rebuild and view pdf, in bash shell execute `make`. To build a gzip-tar file, in bash shell execute `make s` and you'll get `submit.tar.gz`.

Unless otherwise stated, I always mean the *exact* value. That means you can leave your answer with the square root symbol. However you must simplify your answer.

Q1. State the determinant of the following matrix:

$$\begin{bmatrix} -2 & 5 \\ 2 & 2 \end{bmatrix}$$

ANSWER:

Q2. Compute the determinant by scanning the first row:

$$\begin{bmatrix} -2 & 3 & 5 \\ 1 & 0 & -2 \\ 0 & 2 & -3 \end{bmatrix}$$

ANSWER:

$$\begin{aligned} \det \begin{bmatrix} -2 & 3 & 5 \\ 1 & 0 & -2 \\ 0 & 2 & -3 \end{bmatrix} &= (+1)(-2) \det \begin{bmatrix} ? & ? \\ ? & ? \end{bmatrix} + (-1)3 \det \begin{bmatrix} ? & ? \\ ? & ? \end{bmatrix} + (+1)5 \det \begin{bmatrix} ? & ? \\ ? & ? \end{bmatrix} \\ &= (+1)(-2)(?) + (-1)3(?) + (+1)5(?) \\ &=? \end{aligned}$$

(Replace each ? with a real number.)

Q3. Let  $\mathbf{A}$  be the matrix

$$\begin{bmatrix} 1 & 0 & 0 & -2 \\ 2 & 0 & -2 & 0 \\ 1 & 1 & -3 & 0 \\ 3 & 2 & 0 & 0 \end{bmatrix}$$

Compute

$$\det(\mathbf{A} - x\mathbf{I}_4)$$

where  $x$  is a variable. Here,  $\mathbf{I}_4$  is the  $4 \times 4$  identity matrix. You should get a polynomial in  $x$ . Simplify and write your polynomial so that the highest degree term appears first. (In L<sup>A</sup>T<sub>E</sub>X, if you want the polynomial  $x^4 - 2x + 5$ , you type `$x^4 - 2x + 5$`.)

ANSWER:

?

(The above is related the the concept of eigenvectors and eigenvalues. When computing the eigenvalues, traditionally the variable  $x$  is denoted by  $\lambda$ . The eigen decomposition of a matrix is extremely important in studying the properties of the matrix and is used in machine learning, computer vision, differential equations, etc.)

## INSTRUCTIONS

In `main.tex` change the email address in

```
\renewcommand\AUTHOR{jdoe5@cougars.ccis.edu}
```

to yours. In the bash shell, execute “make” to recompile `main.pdf`. Execute “make v” to view `main.pdf`. Execute “make s” to create `submit.tar.gz` for submission.

For each question, you’ll see boxes for you to fill. You write your answers in `main.tex` file. For small boxes, if you see

```
1 + 1 = \answerbox{}
```

you do this:

```
1 + 1 = \answerbox{2}
```

`answerbox` will also appear in “true/false” and “multiple-choice” questions.

For longer answers that needs typewriter font, if you see

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
\end{answercode}
```

you do this:

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
int x;
\end{answercode}
```

`answercode` will appear in questions asking for code, algorithm, and program output. In this case, indentation and spacing is significant. For program output, I do look at spaces and newlines.

For long answers (not in typewriter font) if you see

```
What is the color of the sky?
\begin{answerlong}
\end{answerlong}
```

you can write

```
What is the color of the sky?
\begin{answerlong}
The color of the sky is blue.
\end{answerlong}
```

For students beyond 245: You can put  $\LaTeX$  commands in `answerbox` and `answerlong`.

A question that begins with “T or F or M” requires you to identify whether it is true or false, or meaningless. “Meaningless” means something’s wrong with the statement and it is not well-defined. Something like “ $1+2$ ” or “ $\{2\}^{\{3\}}$ ” is not well-defined. Therefore a question such as “Is  $42 = 1+2$  true or false?” or “Is  $42 = \{2\}^{\{3\}}$  true or false?” does not make sense. “Is  $P(42) = \{42\}$  true or false?” is meaningless because  $P(X)$  is only defined if  $X$  is a set. For “Is  $1 + 2 + 3$  true or false?”, “ $1 + 2 + 3$ ” is well-defined but as a “numerical expression”, not as a “proposition”, i.e., it cannot be true or false. Therefore “Is  $1 + 2 + 3$  true or false?” is also not a well-defined question.

When writing results of computations, make sure it’s simplified. For instance write 2 instead of  $1 + 1$ . When you write down sets, if the answer is  $\{1\}$ , I do not want to see  $\{1, 1\}$ .

When writing a counterexample, always write the simplest.

Here are some examples (see `instructions.tex` for details):

1. T or F or M:  $1 + 1 = 2$  ..... T
2. T or F or M:  $1 + 1 = 3$  ..... F
3. T or F or M:  $1+^2 =$  ..... M

4.  $1 + 2 =$  3

5. Write a C++ statement to declare an integer variable named **x**.

`int x;`

6. Solve  $x^2 - 1 = 0$ .

Since  $x^2 - 1 = (x - 1)(x + 1)$ ,  $x^2 - 1 = 0$  implies  $(x - 1)(x + 1) = 0$ . Therefore  $x - 1 = 0$  or  $x = -1$ . Hence  $x = 1$  or  $x = -1$ .

7. Which is true? ..... C

- (A)  $1 + 1 = 0$
- (B)  $1 + 1 = 1$
- (C)  $1 + 1 = 2$
- (D)  $1 + 1 = 3$
- (E)  $1 + 1 = 4$