MIDTERM EXAMINATION FOR 1051-726-90 Computing for Imaging Science

1. Exam to be given on January 21 or 22 at the mutual convenience of the student and proctor.
2. Exam duration is two hours.
4. Begin each problem on a new sheet of paper. The student name and problem number should be on each page.
5. FAX the completed exam solutions to Harvey Rhody at 585-475-4568.
6. Retain the original exam and solutions.

Thank you for your assistance.

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Problem 1 Given two 2D arrays A and B that have equal sizes, provide an IDL function program shuffle.pro such that the command $C=\text{shuffle}(A,B)$ will return an array $C$ that interleaves the columns of A and B. Your program should not contain any looping statements, such as FOR or WHILE.

Problem 2 An indexed color image is read from a file by

$$A=\text{read\_image}('\text{peppers.png}',rr,gg,bb)$$

You need to construct an array B that can be used to display the brightness (grayscale) image using the command TV,B. Provide a sequence of IDL commands that will construct the array B.

Problem 3 Let A be an array of $N$ columns and $M$ rows. Let the array diagonals be identified by the index $d = \{- (M - 1), -(M - 2), \ldots, -1, 0, 1, 2, \ldots, (N - 1)\}$ as shown in the figure below. The main diagonal is identified by $d = 0$, those that begin along the top of the array by indexes in the range $1 \leq d \leq N - 1$, and those that begin along the sides of the array by negative indexes $-(M - 1) \leq d \leq -1$.

Write an IDL program diag.pro for a function $s=\text{diag}(A,d)$ that will return an array $s$ that contains the elements of $A$ on the diagonal with index $d$. Your function should work for arrays with any number of rows and columns.
Problem 4 A function “testfun” is shown below:

FUNCTION testfun,a,b,SWCH=s
Print,''Number of parameters='',statement_1
CASE statement_2 OF
  0: Print,''a not present or passed by value''
  1: Print,''a present and passed by reference''
ENDCASE
CASE statement_3 OF
  0: Print,''b not present or passed by value''
  1: Print,''b present and passed by reference''
ENDCASE

IF KEYWORD_SET(statement_4) THEN BEGIN
  b=a*b
  print,''Internal value of b='',b
  Return,a*b ;value to be returned if s EQ 0
ENDIF ELSE BEGIN
  b=a+b
  print,''Internal value of b='',b
  Return,a+b ;value to be returned if s NE 0
ENDElse
END

(a) Provide appropriate elements to be filled into the positions labelled statement_1, statement_2, statement_3 and statement_4 in the program above. If you cannot recall the IDL name for a function then provide your own name and explain what it does, with appropriate examples.

(b) What is produced by the following? Explain.

```
a=3
b=4
print,testfun(a,b)
print,''a='',a,'' b='',b
```

(c) What is produced by the following? Explain.

```
a=3
b=4
print,testfun(a,4,/SWCH)
print,''a='',a,'' b='',b
```