1Georgia Institute of Technology
College of Computing
CS 1371 Computing for Engineers
Final - Summer Semester 2007

0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
1	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
2	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
3	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
4	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
5	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
6	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
7	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*
8	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*
9	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*
A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D
E	E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H	H
I	I	I	I	I	I	I	I	I
J	J	J	J	J	J	J	J	J
K	K	K	K	K	K	K	K	K
L	L	L	L	L	L	L	L	L
M	M	M	M	M	M	M	M	M
N	N	N	N	N	N	N	N	N
O	O	O	O	O	O	O	O	O
P	P	P	P	P	P	P	P	P
Q	Q	Q	Q	Q	Q	Q	Q	Q
R	R	R	R	R	R	R	R	R
S	S	S	S	S	S	S	S	S
T	T	T	T	T	T	T	T	T
U	U	U	U	U	U	U	U	U
V	V	V	V	V	V	V	V	V
W	W	W	W	W	W	W	W	W
X	X	X	X	X	X	X	X	X
Y	Y	Y	Y	Y	Y	Y	Y	Y
Z	Z	Z	Z	Z	Z	Z	Z	Z

↑ Print your **Prism username** in the spaces provided, and shade the boxes of the corresponding numbers and/or letters.

I hereby signify that this examination paper contains my own work exclusively, and I have neither given nor received inappropriate help during the taking of this examination, in compliance with the letter and spirit of the Academic Honor Code of Georgia Tech.

Name (print):________________________________

GT ID# 9 0 ___ ___ ___ ___ ___ ___ ___

Signature:____________________________________

TA / Section: ____________________________

Prob.	Poss. Pts	Earned Pts	Lost Pts	by
(cover)	-	-		
1	30			
2	10			
3	20			
4	10			
5	20			
6	20			
7	20			
8	20			
TOTAL	150			

Please Note: *Failure to complete this front sheet correctly will cost you 5% of your grade.*

Please turn off (or silence) and put away any cell phones, beepers/pagers, personal radios or music players that you have in your possession

Good Luck!

Academic misconduct (including - but not limited to - examples on the list below) could result in a zero score on this examination, an "F" final grade in the course, and/or other disciplinary action:

- Failure to cooperate with or follow directions given by a proctor.
- Failure to stop writing when the allotted time is up (as reported by a proctor).
- Communication with anyone other than a proctor for ANY reason in ANY language in ANY manner.
- Sharing of ANYTHING (e.g. pencils, erasers, paper).
- Writing on paper that is not given to you by a proctor.
- Using cell phones, beepers, personal radios or music players, etc. during the exam.
- Using calculators (unless explicitly permitted) or hand-held computers during the exam.
- Using books or other reference material during the exam.
- Disruption of the exam setting.

Reference Section:

`diag(m)` – returns the diagonal elements of the matrix m

`factorial(n)` – returns n!

`find(m)` – returns the indices of the true elements of m

`image(x)` - display the image from the matrix `x`.

`imread(filename)` - returns a matrix representation of an image

`newy = interp1(x,y,newx)` - Interpolates to find newy, the values of the underlying function Y at the points in newx.

`iscell(a)` – checks if `a` is of class cell (a cell array)

`ischar(a)` – checks if `a` is of class char (a string)

`isempty(here)` – checks if `here` is null (usually represented by [], the empty vector

`(x/y/z)label(str)` – labels the plot axes with the given string

`length(a)` – largest dimension of a

`magic(n)` – builds a n * n magic square

`max(a)` – value and index of the max value in a

`mean(a)` – returns the average (mean) value of the vector a

`mesh(x, y, z)` – plot the surface defined by the x, y and z arrays with colored lines and white faces

`[xx, yy] = meshgrid(x, y)` – compute the plaid from the x and y vectors

`min(a)` – value and index of the min value in a

`mod(a, b)` – the remainder when a is divided by b

`mod(a, b)` – the remainder when a is divided by b

`ones(rows, cols)` – generate a matrix filled with 1

`p = polyfit(x,y,n)` – Finds the coefficients of a polynomial P(X) of degree N that fits the data

`y = polyval(p,x)` - Evaluates the polynomial p, at all points in x

`prod(v)` – compute the product of all the elements in a vector v

`sin(th)` – sin of the angle in radians

`size(a)` – all the dimensions of a

`sort(v)` – arranges the vector `v` in ascending numerical order

`newy = spline(x,y,newx)` - Performs cubic spline interpolation to find newy, the values of the underlying function Y at the points in newx.

`sum(v)` – total of all the elements in the vector v

`surf(x, y, z)` – plot the surface defined by the x, y and z arrays with colored faces and black lines

`title(str)` – titles the plot with the given string

`[x, fs] = wavread(file) -` gives the waveform and sampling frequency for a .wav file

`[x, y, z] = xlsread(filename)` - Returns the numeric, text and raw data respectively from an .xls file

`xlswrite(filename, array)` - Writes the array to the .xls file `zeros(rows, cols)` – generate a matrix filled with 0

Problem 1 – General Concepts (30 Points)

A. Computing (5 Points)

Match the terms described below to the statements further below:

A. Ethernet connection	**B. Processor**	**C. RAM memory**	**D. Disk storage**
E. Printer	**F. Monitor**	**G. Keyboard**	**H. Sound System**

1. __“I’m the real brain of the computer—the part that does computation and comparisons.”

2. __ “Plug a cable into me and you can use me for reaching the Internet, other computers, printers, and other resources.”

3. __ “I’m where the computer stores short-term data—when the power stops, I forget everything.”

4. __ “I’m an input device—users can enter text into the computer through me.”

5. __ “I’m a secondary output device—I take digital data and convert it to marks on paper.”

B. True or false (circle your answer) (5 Points)

1. *true false* Code written using if/else can always be rewritten using switch/case.

2. *true false* The double-equals operator should be used to compare two strings.

3. *true false* Nesting if statements accomplishes the same thing as using the **`&`** operator

4. *true false* It is not necessary to define an “else” or “otherwise” case for your conditional statements.

5. *true false* The result of diff(x) is length(x)-1

C. Multiple Choice (20 Points)

1. Fill in the blank with one of the choices to make this script evaluate so that b = 6;

```
a = 1;
b = 0;
if ________
  b = 6;
else
  b = 2;
end
```

A. `b && a`
B. `b || ~a`
C. `~b`
D. `~a`
E. `a == b`

2. Suppose you type the following code into the MATLAB Command Window:

```
mat = [1 2 3; 4 5 6; 7 8 9];
mat(2, 2) = [];
```

What will be the result?

A. This will work; the matrix will just have a hole in the middle.
B. MATLAB will remove the value, altering the matrix's shape in some way to accommodate the removal.
C. MATLAB will assign an empty placeholder value into the matrix, since it can't alter the matrix's shape.
D. MATLAB will generate an error.

3. You are given the following code:

```
[snd, Fst] = wavread('Sound.wav');
```

Which of the following lines of code will play an amplified version of Sound.wav

A. `sound(snd, Fst*3);`

B. `sound(snd(round(1:half^2:end)), Fst)`

C. `sound(snd*3, Fst);`

D.
```
z= fft(snd)
 z(1:floor(length(z)/2)) = 255;
 sound(ifft(z), Fst);
```

4. What is the Big O (algorithm efficiency) for Insertion Sort?

A. N ^ 2
B. N
C. N * log N
D. log N
E. None of the above

5. What will the following code do?

```
Img = imread('picture.jpg');
Img(: , : , 3) = 0;
```

A. Eliminate all of the blue in Img
B. Eliminate all of the green in Img
C. Increase all of the green in Img
D. Increase all of the blue in Img
E. None of the above

Problem 2 – Tracing (10 Points)

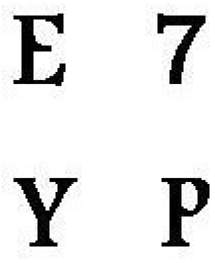
```
function New = Pixar(structure)
if length(structure.fix) > 1
   pic = imread(structure.image);
   [r,c,l]=size(pic);
   rmid=r/2;
   cmid=c/2;
   temp1=pic(1:rmid,1:cmid,:);
   pic(1:rmid,1:cmid,:)=pic(rmid+1:end,cmid+1:end,:);
   pic(rmid+1:end,cmid+1:end,:) = temp1;
   structure.image = pic;

   [note fs] = wavread(strcuture.sound);
   n = length(note);
   factor = 2^(2/12);
   index = round(linspace(1,n,n/factor));
   newsound = note(index)
   structure. sound = newsound;
else
    if strcmp(strcture.fix{1},'img') || …
            strcmp(strcture.fix{2},'img')
        pic = imread(strcture.image);
        [r,c,l]=size(pic);
        rmid=r/2;
        cmid=c/2;
        pic(rmid+1:end,:,:) = pic(rmid+1:end,end:-1:1,:);
        structure.image = pic;
    else
        [note fs] = wavread(strcuture.sound);
        note = note(3*fs:4*fs);
        strcuture.sound = note;
    end

end
```

Now you have an image file **pic.jpg** looks like the picture below and a sound file **soundV.wav** which has 55,000 samples and its sampling frequency 11,000Hz.

pic.jpg looks like…



```
movie = struct('fix',{'img', 'sound'}, …
        'image','pic.jpg', 'sound', 'soundV.wav')

New = Pixar(movie)
```

What's the result after running the above MATLAB code?

A. Draw `New.image` in the box.

B. Describe the difference between `movie.sound` and `New.sound`

Problem 3 – Debugging (20 Points)

You are the manager of a warehouse. The warehouse just had a big sale in the past few days. Your employees gave you an excel spreadsheet that contains the numbers of items sold each day in the format as seen below. You want to know the total amount of each item that have been sold by up to that day and write that data to a file with a different filename and plot the total number of items sold by each day.

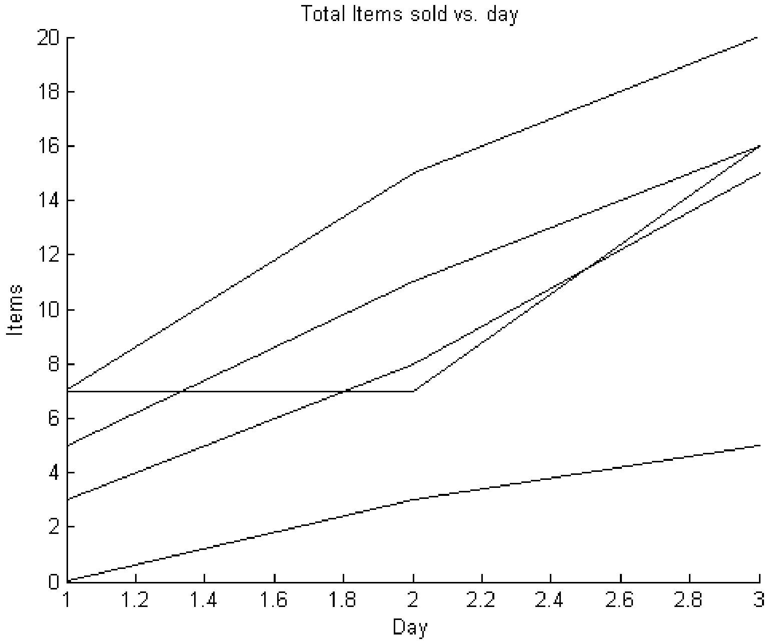
Your original file may look like:

	Day 1	Day 2	Day3
Item1	7	0	9
Item2	0	3	2
Item3	5	6	5
Item4	7	8	5
Item5	3	5	7

Your new file should look like:

	Day 1	Day 2	Day3
Item1	7	7	16
Item2	0	3	5
Item3	5	11	16
Item4	7	15	20
Item5	3	8	15

Your graph should look like:



However, the code below contains errors in ***five*** lines. Find all the errors and correct them on the answer sheet.

**** There might be more than one error per line.***
**** You may only correct five lines. Points will be deducted if more than five lines are being marked or corrected.***

(The code is on the next page)

```
   1-  function graphSale(filename)

➔  2-  [num txt raw] = xlsread('filename');
➔  3-  [rows cols] = size(raw);
   4-  clrs = 'rgbcmyk';
➔  5-  for init = 1:cols-1
➔  6-      data = cumsum(num(init,:));
   7-      hold on
➔  8-      plot(1:cols-1,data,clrs(mod(init,7)+1));
   9-      hold off
➔ 10-      for init2 = 2:cols
➔ 11-          raw(init+1,init2) = data(init2-1);
  12-      end
  13-  end
➔ 14-  title{'Total Items sold vs. day'}
➔ 15-  xlabel('Day'), ylabel('Items')

➔ 16-  newfilename = [filename(1:end-4); '_New.xls'];
  17-  xlswrite(newfilename,raw);
```

Answer Sheet (*circle error if there's an error*)

2- **error** ____

3- **error** ____

5- **error** ____

6- **error** ____

8- **error** ____

10- **error** ____

11- **error** ____

14- **error** ____

15- **error** ____

16- **error** ____

Problem 4 – Sorting (10 Points)

A. Consider the following code and answer the question below:

```
function b = mySort(a)
b = a;
sz = length(a);
if sz > 1
    szb2 = floor(sz / 2);
    first = mySort(a(1 : szb2));
    second = mySort(a(szb2+1 : sz));
    b = helperSort (first, second);
end
b = b';

function b = helperSort(first, second)
i1 = 1;
i2 = 1;
out = 1;
while (i1 <= length(first)) & (i2 <= length(second))
    if lt(first(i1), second(i2))
        b(out,1) = first(i1); i1 = i1 + 1;
    else
        b(out,1) = second(i2); i2 = i2 + 1;
    end
    out = out + 1;
end
while i1 <= length(first)
    b(out,1) = first(i1); i1 = i1 + 1; out = out + 1;
end

while i2 <= length(second)
    b(out,1) = second(i2); i2 = i2 + 1; out = out + 1;
end
```

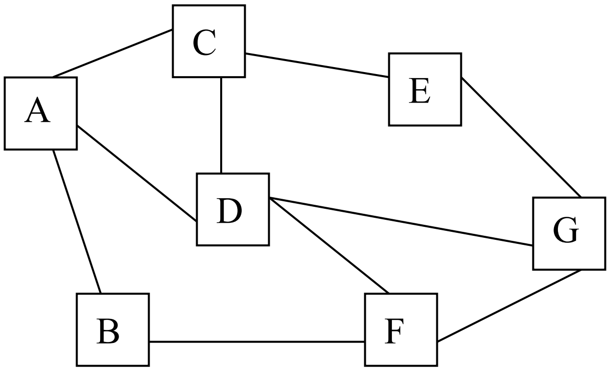
Identify the sorting technique implemented in the code above: ______________________

B. Perform a **Quick Sort** on the following set of data. Show each step of the process:

[34 61 96 35 87 16 23 2 48 126]

Problem 5 – Graph Search (20 Points)

Do queues traversing of the following graphs using Breath-First algorithm. Make a list of visited nodes and the final path from A to G.



Visited List Queue Contents

Problem 6 – Coding (20 Points)

Write a function called **PolyFun** which takes x vector, y vector, and another vector. The third vector consists of three positive integers correspond to three different orders of polynomials that you wish to fit.

The function plots the original data set as black *'s with the other three curve fits in red, green, and blue, respectively, on the same graph. You should use the smallest value and the largest value in x vector with 2000 points to do the curve fitting.

Problem 7 – Coding (20 Points)

Write a recursive function called **calcGCD** that calculates the greatest common denominator. The function takes in 2 integers and returns an integer. An example of how you can do this is below for 122 and 14.

X	Y	Remainder
122	14	10
14	10	4
10	4	2
4	2	0

Therefore the GCD of 122 and 14 is 2.

**** You must use recursion to solve this problem.***

Problem 8 - Coding (20 Points)

Write a function called **VelocityCoeff** which takes in an excel file name and returns two different vectors which are the coefficients of position function and acceleration function respectively. The columns on the excel file contains the coefficients of a velocity function as a polynomial function of time in ascending order, starting with the constant where V(t) = 1st coeff + t*2nd coeff + t^2 * 3rd coeff…

The way to get the coefficients of the position and acceleration functions is integrating and differentiating the velocity function respectively. You may assume the constant of integration is zero.

***You may assume the excel file only contains one row.**

```
function [pos acc] = VelocityCoeff(filename)
% The function header is given. Your code goes here…
```

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