

Problem 1 – Sorting [20 Points]

I. The efficiency of the algorithm

Criteria:

- 5 Points - All or nothing

II. N^2

$N \log N$

$N \log N$

N^2

Criteria:

- -1 point each for every incorrect answer
- 5 Points for all correct

III.

[9 1 18 20 5 8 2]

[9]

[1 9]

[1 9 18]

[1 9 18 20]

[1 5 9 18 20]

[1 5 8 9 18 20]

[1 2 5 8 9 18 20]

Criteria:

- -1 point each for every incorrect line
 - 10 Points for all correct
 - If the vector is not sorted until the end, give them a 0 for this part.
-

Problem 2 – Graphs [20 Points]

I.

- 5 points for marking at least one each of a node, an edge, and a cycle.
- -2 points for each unmarked characteristic (node, edge, and cycle)

II.

Path	Priority Queue
A	A
B-A	B-A
D-A	D-A
C-D-A	C-D-A
F-B-A (optional)	F-B-A
G-C-D-A	G-C-D-A
	C-B-A
	H-F-B-A

Thus, A-D-C-G is the shortest path.

Criteria:

- 5 points for correct final answer
 - 10 points for showing work. Note that they must clearly show how they used Dijkstra's algorithm to obtain their answer. If you're unsure whether they did this, just ask!
-

Problem 3 – Numerical Methods [20 Points]

I. B and C

Criteria

- 5 points (All or nothing)

II.

```
a = [1 1 1 1]
b = [1 3 6 10 15]
```

Criteria

- 5 points if both a and b are right (All or nothing)
- 3 points if only one of a or b is right

III.

```
coeffs = polyfit(time, distance, 5)
xx = 1:0.1:10; % any stepsize is okay
yy = polyval(coeffs, xx)
plot(xx, yy);
```

Criteria

- 3 points for correctly using polyfit
- 2 points for correctly using polyval

IV. C

Criteria

- 5 points each (All or nothing)
-

Problem 4 – Plotting [20 Points]

I. C, D

II. z axis

III.A

IV.

```
shading interp; % or flat
title('Rotation about the x-axis');
xlabel('x-axis');
ylabel('y-axis');
zlabel('z-axis');
```

Criteria:

- 5 points each for complete correct answer for each part

NOTE: If any of them is incorrect, but after the error if the remaining parts have been calculated correctly based on the incorrect output, give them points for the rest.

Problem 5 – Images/Sounds [20 Points]

I. B

II. C

III. True

IV. C

Criteria

- 5 points (All or nothing)

Problem 6 – Miscellaneous [20 Points]

I. E

II. 10

III. C

IV. E

Criteria

- 5 points (All or nothing)

Problem 7 – Structure Arrays [20 Points]

I. A, C, E

Criteria

- 5 points if completely right, otherwise:
- 2 points each for circling A, C, and E, and:
- -2 points each for circling either B or D

II.

A = 1 or True

B = 0 or False

C = 'curb'

D = [] or ''

E = 'band', 'album', 'song'

Criteria

- 3 points each (All or nothing)

Problem 8 – Sorting [20 Points]

I. The efficiency of the algorithm

Criteria:

- 5 Points - All or nothing

II. N^2

$N \log N$

$N \log N$

N^2

Criteria:

- -1 point each for every incorrect answer
- 5 Points for all correct

III.

[9 1 18 20 5 8 2]

[9 1 18 20] [5 8 2]

[9 1] [18 20] [5 8] [2]

[9] [1] [18] [20] [5] [8] [2]

[1 9] [18 20] [5 8] [2]

[1 9 18 20] [2 5 8]

[1 2 5 8 9 18 20]

Criteria:

- -2 point each for every incorrect line
- 10 Points for all correct

Problem 9 – Graphs [20 Points]

I.

Criteria:

- 5 points for marking at least one each of a node, an edge, and a cycle.
- -2 points for each unmarked characteristic (node, edge, and cycle)

II.

Path	Priority Queue
A	A
B-A	B-A
D-A	D-A
C-D-A	C-D-A
F-B-A (optional)	F-B-A
G-C-D-A	G-C-D-A
	C-B-A
	H-F-B-A

Thus, A-D-C-G is the shortest path.

Criteria:

- 5 points for correct final answer
 - 10 points for showing work. Note that they must clearly show how they used Dijkstra's algorithm to obtain their answer. If you're unsure whether they did this, just ask!
-

Problem 10 – Plotting [20 Points]

I. C and D

II. x axis

III. D

IV.

```
shading interp;  
title('Rotation about the x-axis');  
xlabel('x-axis');  
ylabel('y-axis');  
zlabel('z-axis');
```

Criteria:

- 5 points each for complete correct answer for each part
-

Problem 11 – Images/Sounds [20 Points]

- 1.D
- 2.C
- 3.D
- 4.B

Criteria:

- 5 points each (All or nothing)
-

Problem 12 – Vector Manipulations/Functions [20 Points]

- I. A = {'ES&T' 'Woodruff' 'Smith'}
- II. Cell array or cell
- III. B = -2
- IV. A = 'ES&TWoodruffSmith'
- V. character array or char or string

Criteria:

- 5 points each (All or nothing)

NOTE: If any of them is incorrect, but after the error if the remaining parts have been calculated correctly based on the incorrect output, give them points for the rest.

Problem 13 – Structure Arrays [20 Points]

II. A, B, E

Criteria

- 5 points if completely right, otherwise:
- 2 points each for circling A, B, and E, and:
- -2 points each for circling either C or D

II.

A = 1 or True

B = 1

C = 5

D = 'Shardul'

E = 'Name', 'Age', 'Experience', 'Age'

Criteria:

- 3 points each for complete correct answer for each part
- C = 5
- D = 'Shardul'
- E = 'Name', 'Age', 'Experience', 'Age'

Criteria:

- 3 points each for complete correct answer for each part
-

Problem 14 – Miscellaneous [20 Points]

I. E

II. D

III. D

IV. C

Criteria:

- 5 points each (All or nothing)
-

Problem 15 – Sorting [20 Points]

I. The efficiency of the algorithm

Criteria:

- 5 Points - All or nothing

II. N^2

$N \log N$

$N \log N$

N^2

Criteria:

- -1 point each for every incorrect answer
- 5 Points for all correct

III.

[9 1 18 20 5 8 2]

[1 5 8 2] [9] [18 20]

[1] [5 8 2] [18] [20]

[2] [5] [8]

[1 2 5 8 9 18 20]

Criteria:

- -2 point each for every incorrect line
- 10 Points for all correct

Problem 16 – Images/Sounds [20 Points]

5.C

6.C

7.B

8.E

Criteria:

- 5 points each (All or nothing)
-

Problem 17 – Plotting [20 Points]

1. C and D

2. z axis

3. B

4.

```

shading interp; % or flat
title('Rotation about the x-axis');
xlabel('x-axis');
ylabel('y-axis');
zlabel('z-axis');

```

Criteria:

- 5 points each for complete correct answer for each part

Problem 18 – Graph Traversal [20 Points]

Path	Queue
	A
A	B-A
B-A	C-B-A
C-B-A	D-B-A
D-B-A	F-C-B-A
F-C-B-A	E-D-B-A
E-D-B-A	G-D-B-A
G-D-B-A	H-F-C-B-A
H-F-C-B-A	I-G-D-B-A
I-G-D-B-A	J-I-G-D-B-A
J-I-G-D-B-A	

Thus, A-B-D-G-I-J will be the path taken.

Criteria:

- 20 points for completely correct answer
 - If no work is shown, only 5 points for the right path
 - If the answer is incorrect but the work shows the process of a BFS, 10 points
-

Problem 19 – Miscellaneous [20 Points]

1. numzero = 5, nummax = 7
2. B, D % 3 points for each correct answer (if both are not marked)
3. C
4. A, B, C % 2 points for each correct answer (if all 3 are not marked)

Criteria

- 5 points each (All or nothing)

Problem 20 – Miscellaneous [20 Points]

- I. (i) False (0)
(ii) True (1)
(iii) False (0)
- II. 6
- III. D
- IV.


```
coeffs = polyfit(time, distance, 4)
xx = 1:0.1:10; % any step size is okay
yy = polyval(coeffs, xx)
plot(xx, yy);
```

Criteria

- 5 points each (All or nothing)

Problem 21 – Structures [20 Points]

- III. A, B, E % 2 points for each correct answer

Criteria

- 5 points if completely right, otherwise:
- 2 points each for circling A, B, and E, and:
- -2 points each for circling either C or D

- II.
 - V. Make: 'Honda' Model: 'Civic' Year: 2001
 - VI. Make: 'Mazda' Model: 'Protege' Year: 2000 Mileage: 200000 Age: []
 - VII. 1 or True
 - VIII. 2001
 - IX. 'Make' 'Model' 'Year'

Criteria

- 3 points each (All or nothing)

Problem 22 - Computing [10 Points]

- II. B
- III. H
- IV. A
- V. C
- VI. G
- VII. F
- VIII. E
- IX. D

Criteria:

- -1 point each for every incorrect answer
 - 10 Points for all correct
-

Problem 23 – Sorting [20 Points]

I. The efficiency of the algorithm

Criteria:

- 5 Points - All or nothing

II. N^2

$N \log N$

$N \log N$

N^2

Criteria:

- -1 point each for every incorrect answer
- 5 Points for all correct

[9 1 18 20 5 8 2]

[9]

[1 9]

[1 9 18]

[1 9 18 20]

[1 5 9 18 20]

[1 5 8 9 18 20]

[1 2 5 8 9 18 20]

Criteria:

- -1 point each for every incorrect line

- 10 Points for all correct
 - If the vector is not sorted until the end, give them a 0 for this part.
-

Problem 24 – Vector Manipulation [20 Points]

I.

$$\mathbf{b} = [0 \quad 0 \quad 0 \quad 1 \quad 1]$$

$$\mathbf{c} = [1 \quad 2 \quad 5]$$

$$\mathbf{e} = [1 \quad 0 \quad 1]$$

Criteria:

- 5 points each (All or nothing)
- If one of them is wrong, but the remaining are correct with erroneous vector carried forward, give them credit for the rest

II. A, B, C

Criteria:

- 5 points (All or nothing)
-

Problem 25 – Structure Arrays [20 Points]

I. D

Criteria:

- 5 points (All or nothing)

II.

temp1 = Name: 'XBOX360'

temp2 = Name: 'XBOX360' Price: '400'

temp3 = Name: 'NES' Price: 'Free'

Criteria:

- 5 points each (All or nothing)
 - If one of them is wrong, but the remaining are correct with erroneous vector carried forward, give them credit for the rest
-

Problem 26 – Graphs [20 Points]

A. 5 points for marking any node, edge and a cycle

B.

Path	Priority Queue
A	B-A
	D-A
B-A	D-A
	F-B-A
	C-B-A
D-A	F-B-A
	C-B-A
	C-D-A
F-B-A	C-B-A
	C-D-A
	H-F-B-A
C-B-A	C-D-A
	H-F-B-A
	D-C-B-A
	D-C-B-A
	G-C-B-A
	H-C-B-A

Thus, A-B-C-G will be the path taken.

Criteria:

- 15 points for correct answer
- If no working is shown, only 5 points for the right path
- If incorrect answer but has done something, 10 points

Problem 27 – Numerical Methods [20 Points]

5. C and D

6.

$a = [1 \ 1 \ 1 \ 1]$

$b = [1 \ 3 \ 6 \ 10 \ 15]$

7. `coeffs2 = coeffs(1:end-1).*((length(coeffs)-1):-1:1)`

8. B

Criteria

- 5 points each (All or nothing)
-

Problem 28 – Plotting [20 Points]

A. C, D

B.

2. z axis

3.

```
xx = vv;  
rr = -5xx.^4 + 2*xx.^2 - 9*xx + 13;  
yy = rr.*cos(tth);  
zz = rr.*sin(tth);  
surf(xx,yy,zz);
```

4.

```
shading interp;  
title('Rotation about the x-axis');  
xlabel('x-axis');  
ylabel('y-axis');  
zlabel('z-axis');
```

Criteria:

- 5 points each for complete correct answer for each part

NOTE: If any of them is incorrect, but after the error if the remaining parts have been calculated correctly based on the incorrect output, give them points for the rest.

Problem 29 – Images/Sounds [20 Points]

- X. B
- XI. C
- XII. True
- XIII. A

Criteria

- 5 points (All or nothing)
-

Problem 30 – Images/Sounds [20 Points]

1. A
2. B
3. A (The question had a typo – it should have said “ $\mathbf{b} = [\mathbf{c}; \mathbf{a}]$;”. If it was not announced during the test, give them points for marking anything.)
4. C

Criteria:

- 5 points each (All or nothing)

Problem 31 – Graph Traversal [20 Points]

PATH	Queue B
B	B-D B-A
B-D	B-A B-D-E B-D-F
B-A	B-D-E B-D-F B-A-E B-A-H B-A-C
B-D-E	B-D-F B-A-E B-A-H B-A-C B-D-E-A B-D-E-F B-D-E-G B-D-E-C

Thus, B-D-E-G will be the path taken.

Criteria:

- 20 points for correct answer

- If no working is shown, only 5 points for the right path
- If incorrect answer but has done something, 10 points

Problem 32 – Plotting [20 Points]

1. C, D

2. x axis

3.

```
rr = vv;
xx = rr.*cos(tth);
yy = rr.*sin(tth);
zz = -rr.^3 + 5*rr.^2 - 21*rr + 43;
surf(xx,yy,zz);
```

4.

```
shading interp;
title('Rotation about the x-axis');
xlabel('x-axis');
ylabel('y-axis');
zlabel('z-axis');
```

Criteria:

- 5 points each for complete correct answer for each part

NOTE: If any of them is incorrect, but after the error if the remaining parts have been calculated correctly based on the incorrect output, give them points for the rest.

Problem 33 – Miscellaneous [20 Points]

XIV. C

XV.

$A = \{ \text{'cat'} \quad [7 \ 6 \ 9] \quad \{\text{'dog'}\}$

$a = \text{'dog'}$

$b = c$

$c = [7 \ 6 \ 9]$

$d = \{[7 \ 6 \ 9]\}$

XVI. C

```

4.
A = [3 2 -1; 6 0 1; 5 -2 1]
B = [5; 7; 12]
C = inv(A)*B
x = C(1);
y = C(2);
z = C(3);

```

%If they don't split C into x y and z separately, ignore it

Criteria

- 5 points each (All or nothing)

Problem 34 – Recursion [20 Points]

1. A C D

Criteria

- 5 points each (All or nothing)

2.

```

II.  if length(str) == 0
        ret = 1;
    elseif length(str) == 1
        ret = 1

```

III. 0

IV. 1

V. 5

VI.

```

function ret = pwrap(x)
x(find(x == ' ')) = [];

```

Criteria

- 3 points each (All or nothing)

Problem 35 – Structures [20 Points]

A = 1

B = 25

C = 0

D = 0

E = 'Chelsea'

Criteria

- 5 points each (All or nothing)

Problem 36 – Images/Sounds [20 Points]

9. C
10. C
11. B
12. E

Criteria:

- 5 points each (All or nothing)
-

Problem 37 – Vector Manipulations [20 Points]

1. (a) will produce an error as a and b are not of equal length
2. False. $(\text{pie} < 4) = [0\ 0\ 0\ 0\ 1]$ which is not the same as $[1\ 1\ 1\ 0\ 0]$
3. `teehee = [6 4 3 2 1]`
4. `ice_cream = [8 6 4 2 0 2 4 6 8]`

Criteria:

- 5 points each (All or nothing)
-

Problem 38 – Plotting [20 Points]

1. C and D
2. z axis
3.


```
xx = vv;
rr = -5xx.^4 + 2*xx.^2 - 9*xx + 13;
yy = rr.*cos(tth);
zz = rr.*sin(tth);
surf(xx,yy,zz);
```
4.


```
shading interp;
title('Rotation about the x-axis');
xlabel('x-axis');
ylabel('y-axis');
zlabel('z-axis');
```

Criteria:

- 5 points each for complete correct answer for each part

NOTE: If any of them is incorrect, but after the error if the remaining parts have been calculated correctly based on the incorrect output, give them points for the rest.

Problem 39 – Graph Traversal [20 Points]

Path	Queue
	A
A	B-A
B-A	C-B-A
	D-B-A
C-B-A	D-B-A
	F-C-B-A
D-B-A	F-C-B-A
	E-D-B-A
	G-D-B-A
F-C-B-A	E-D-B-A
	G-D-B-A
	E-F-C-B-A
	H-F-C-B-A
E-D-B-A	G-D-B-A
	E-F-C-B-A
	H-F-C-B-A
	F-E-D-B-A
G-D-B-A	E-F-C-B-A
	H-F-C-B-A
	F-E-D-B-A
	H-G-D-B-A
	I-G-D-B-A
E-F-C-B-A H-F-C-B-A	F-E-D-B-A
	H-G-D-B-A
	I-G-D-B-A
	D-E-F-C-B-A
H-F-C-B-A F-E-D-B-A	H-G-D-B-A
	I-G-D-B-A
	D-E-F-C-B-A
	I-H-F-C-B-A
	G-H-F-C-B-A
F-E-D-B-A H-G-D-B-A	I-G-D-B-A
	D-E-F-C-B-A
	I-H-F-C-B-A
	G-H-F-C-B-A

	H-F-E-D-B-A
H-G-D-B-A I-G-D-B-A	D-E-F-C-B-A
	I-H-F-C-B-A
	G-H-F-C-B-A
	H-F-E-D-B-A
	I-H-G-D-B-A
I-G-D-B-A D-E-F-C-B-A	I-H-F-C-B-A
	G-H-F-C-B-A
	H-F-E-D-B-A
	I-H-G-D-B-A
	H-I-G-D-B-A
	J-I-G-D-B-A

Thus, A-B-D-G-I-J will be the path taken.

Criteria:

- 20 points for correct answer
- If no working is shown, only 5 points for the right path
- If incorrect answer but has done something, 10 points

Problem 40 – Miscellaneous [20 Points]

1. (i) False
(ii) True
(iii) False
2. 6
3. C
4. C

Criteria

- 5 points each (All or nothing)

Problem 41 – Structures [20 Points]

- I. 1
- II. 'white'
- III. 1
- IV. 'accord'
- V. 'wing'

Criteria

- 5 points (All or nothing)
