**INSTRUCTIONS TO STUDENTS:**

1. Understand that cheating is a serious offense.

**SIGNATURE:**

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**SEAT NUMBER:**

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**STUDENT NUMBER:**

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**NAME:** (Print in ink)

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(a) What is the result of the matrix operation?

\[
\begin{bmatrix}
0 & 0 & 0 \\
2 & 1 & 0 \\
-1 & 1 & 0 \\
1 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
1 \\
0 \\
1
\end{bmatrix}
\]

(b) Which of the following is not inside the feasible set.

\[
\begin{align*}
1 + x & = a \\
2 + x & = b \\
2 - x & = c \\
1 & = x
\end{align*}
\]

(c) Which of the following is an objective function?

\[
\begin{bmatrix}
-1 & 1 \\
1 & 1
\end{bmatrix}
\begin{bmatrix}
9 \\
6
\end{bmatrix}
\]

Multiple Choice Questions
(1) True, when is a matrix of a non-empty graph. If \( M = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \), then there is a path from \( A \) to \( B \), from \( B \) to \( C \), and from \( C \) to \( A \).

(14) Let \( M = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \) be the adjacency matrix of \( K_3 \).

(a) True
(b) False
(c) False
(d) False
(e) False
(f) False
(g) True
(h) False
(i) False
(j) False
(k) True
(l) False

(15) Write the following graphs are connected:

(a) No edge
(b) Connected
(c) Connected
(d) Connected
(e) Connected
(f) Connected
(g) Connected
(h) Connected
(i) Connected
(j) Connected

(16) Classify the sequence of vertices: \( A \), \( B \), \( C \), \( D \), \( E \), \( F \).

(a) A-B-C-D-E-F
(b) A-C-E-D-B-F
(c) A-D-B-C-E-F
(d) A-D-B-C-E-F

(17) What is the solution to \( x + y = 3 \) and \( 2x + 3y = 6 \)?

(18) In the matrix:

\[
\begin{bmatrix}
0 & 1 & 0 \\
0 & 0 & 1 \\
1 & 0 & 0
\end{bmatrix}
\]

(19) Every path is a sequence of vertices:

(a) A-B-C-D-E-F
(b) A-C-E-D-B-F
(c) A-D-B-C-E-F
(d) A-D-B-C-E-F

(20) Consider the following graph:

For questions 11 through 12, consider the graph:

(a) No edge
(b) Connected
(c) Connected
(d) Connected
(e) Connected
(f) Connected
(g) Connected
(h) Connected
(i) Connected
(j) Connected

(21) Examines the following question:

(a) No edge
(b) Connected
(c) Connected
(d) Connected
(e) Connected
(f) Connected
(g) Connected
(h) Connected
(i) Connected
(j) Connected

(22) Examines the following question:

(a) No edge
(b) Connected
(c) Connected
(d) Connected
(e) Connected
(f) Connected
(g) Connected
(h) Connected
(i) Connected
(j) Connected

(23) Examines the following question:

(a) No edge
(b) Connected
(c) Connected
(d) Connected
(e) Connected
(f) Connected
(g) Connected
(h) Connected
(i) Connected
(j) Connected
(19) What is the GCD of 84 and 30?

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 6
- (u) 12
- (v) 14

(20) When is the smallest positive integer

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 6
- (u) 12
- (v) 14

(21) When is the smallest positive integer

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 6
- (u) 12
- (v) 14

(22) How many edges are there in the graph of the incidence matrix?

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 5
- (u) 6
- (v) 7

(23) n-1

(24) How many vertices are there in the graph of the incidence matrix?

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 5
- (u) 6
- (v) 7

The following incidence matrix:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

For question 16 through 17, consider the matrix of a graph. If |n| = 1, then what is the incidence matrix?

- (a) 0
- (p) 1
- (q) 2
- (r) 3
- (s) 4
- (t) 5
- (u) 6
- (v) 7
2. [10 points] Graph the following feasible set. Find and label all corner points.

\[
\begin{align*}
& -4x + 2.4y > 0 \\
& 3y - 2x - 5 \\ & x \\ & y \\
& 0 \\
& 0 \geq x
\end{align*}
\]

Long Answer
3 = \pi + \varepsilon

\Pi = \pi - \varepsilon

inverse of the coefficient matrix. No marks will be awarded for any other method.

3. [10 points] Solve the following system of equations by using the method of finding the
4. [10 points] Consider the following graph:

- Find an example of each of the following in the above graph, or explain why they do not exist:
  1. Euler Path
  2. Hamilton Path
  3. Hamilton Circuit
  4. Euler Circuit

5. What is the degree sequence for this graph?
<table>
<thead>
<tr>
<th>Hexadecimal</th>
<th>Octal</th>
<th>Binary</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>164</td>
<td>1011</td>
<td>73</td>
</tr>
</tbody>
</table>

5. Fill in the blanks.
6. [10 points] Use the Euclidean Algorithm method to find an integer solution for:

\[ 187x + 60y = 1 \]
7. (5 points) (BONUS: 5 MARKS) Find a valid 4-coloring of the following graph, or explain why one does not exist.