Mansoura University Faculty of Science Dept. of Mathematics Image Processing		4ᵗʰ year Time: 2 Hours Date: 30/6/2012 Maximum 60 Marks

Answer the following questions:

Question #1 [20 Marks]

a) What is meant by digital image?

b) State the criteria of a good image?

c) How many bits are required to produce 200 grey levels?

d) What is the relation between quality of image and the number of stored images?

e) What are the characteristics of digital image processing? State its components?

f) Write Matlab statements to:-

1. Determine the size of an image
2. Determine the bit depth of image file
3. Write a grayscale image to a 4-bit PNG file.
4. Determine how many images are stored in a file

g) What is the difference between:-
1. Human vision and imaging machine
2. RGB and indexed representation

Question #2 [20 Marks]

a) What is meant by image compression? Clarify its different types?

b) State the applications of:

1. Image Coding   2. Image Enhancement   3. Image Restoration

c) How many grary-levels that can be produced in 32 bit monochrome image?

d) State the stages of JPEG encoder?

e) What are the advantages of JPEG 2000?

f) Describe the structure of BMP?

g) Draw the block diagram which describes the image processing operations?

Faculty of Science Computer Science Department 3rd - Level		Date: June 2012 Subject: Algorithms Time Allowed: 2 Hours Total Marks: 80 Marks

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Answer only FOUR Questions

Question 1:[20 Marks]

A- Use the Master method to solve the following recurrences

   i. $T(3n)=T(2n/9)+\Theta(n^3)$ ii. $T(n)=7T(n/2)+\Theta(n^2)$

B- Use the substitution method to verify that the running time for the recurrence relation $T(n)=9T(n/3)+n^2$ is of order $O(n^2 \lg(n))$.

C- Use the recursion tree to find a good guess for the recurrence $T(n)=7T(n/3)+ \lg(n)$.

Question 2:[18 Marks]

A- Write both the tilde approximations and the order of growth for the following:

     I. $3N^4 - 150 \lg(N^3) - 12N$ **II.** $(N^3 - 3/N)(2^N - 12/N)$ **III.** $(2+1/N)7^N + 5\lg(N)$

B- Find the running time of the merge sort algorithm; then illustrate the behaviour of Merge Sort on the following array of integers $\{2, 4, 19, 8, 9, 17, 5, 3\}$.

C- Analyze the following algorithm to find an asymptotic upper bound of its execution

     function multiply(x,y)

         Input: Positive integers x and y, in binary

         Output: The product of x, y

             $n = \max(size\ of\ x,\ size\ of\ y)$

             if$(n=1)$ return $x.y$

             x_L= leftmost $n/2$ bytes of x, x_R =rightmost $n/2$ bytes of x

             y_L=leftmost $n/2$ bytes of y, y_R=rightmost $n/2$ bytes of y

             P_1=*multiply*(x_L, y_L)

             P_2=*multiply*(x_R, y_R)

             P_3=*multiply*$(x_L+x_R,\ y_L+y_R)$

             return $P_1.2^n+(P_3-P_1-P_2).2^{n/2}+P_2$.

Question 3:[18 Marks]

A- Use the recursion tree method to get a Θ estimate of the following recurrence; then verify it using the substitution method.

$$T(2n)=T(n/5)+T(3n/4)+O(n)$$

B- Compute the running time complexity of the following two algorithms:

| I.	II.

function **Sum** (*array* A, *int* n)
{
    Sum=0
    for (i=0; i<n ; i++)
        Sum=*Sum*+A[i]
    Return Sum
}
	function **LSUM** (*N*)
	{
	    int sum=0;
	    for (int i=1; i < N ; i++)
	        for (int j=N ; j >0 ; j=j/2)
	            sum+=j;
	    Return Sum
	}

C- Rewrite the algorithms in **(3-B)** as multithreaded algorithms; then, find their parallelism. **Hint.** Ensure that the multithreaded algorithms have no race conditions.

See Next page ☞

Question 4:[24 Marks]

A- Prove that the Quick-Sort's average case running time is O(nlg(n)).

B- Illustrate the operation of MAX-HEAPIFY (A,3) on the array A ={27; 107; 30; 16; 13; 104; 12; 132; 44; 328; 9 } in the Heap-Sort algorithm.

C- Write the Insertion Sort Algorithm, and state the order of growth (Θ) of its running time. Then, illustrate the behaviour of Insertion Sort on the following array of integers {92, 34, 109, 18, 9, 107, 15, 23}.

D- For the (n x n) matrices A,B,X, write a multithreaded algorithm that uses divid and conquer method to find the matrix Y where Y=A*X+B; then find the parallelism of this algorithm.

Question 5:[24 Marks] Study the following graph algorithm, then answer the questions following it.
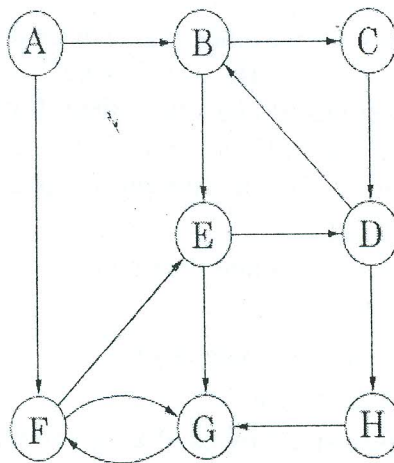
A. Define the adjacency matrix for the graph.

B. Perform Depth-First Search on the graph (starting from node A); *whenever there's a choice of vertices, pick the one that is alphabetically first*. Classify each edge as a tree edge, forward edge, back edge, or cross edge, and give the **first visit** and **final visit** order of each vertex., and state the complexity of its performance

C. Draw the DFS search forest results from the DFS algorithm.

D. Identify the strongly connected components within the graph.

E. Perform the Breadth-First Search on the graph (starting from node A); whenever there's a choice of vertices, pick the one that is alphabetically first.

F. Draw the Breadth-First search tree.

G. Find the shortest path of each vertex from node A.

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End of Questions

Good-Luck   Dr. Mohammed Alrahmawy
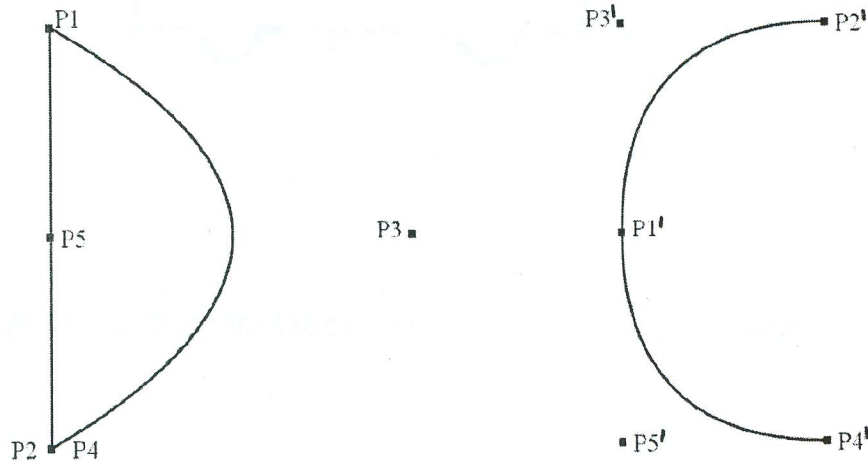
Please answer the following questions:

Q1: Define the following: (10 points)

1. Java applications
2. Benefits of Programming in Java
3. Image Formation
4. Image processing
5. Image Processing Applications
6. Computer Graphics Application Fields
7. Applications of transformations
8. Antialiasing, draw an example.

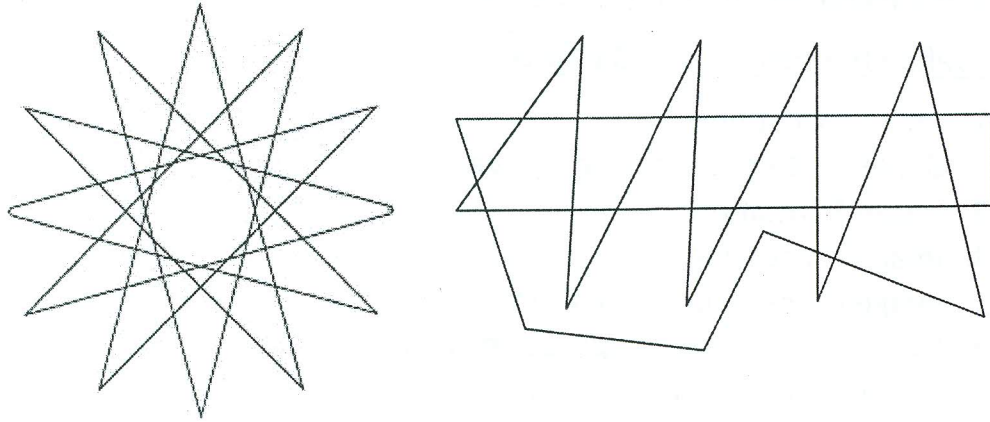## Q2: Write the differences between the following: (10 points)

1. Raster graphics and vector graphics.
2. QuadCurve2D and CubicCurve2D.
3. Lines and areas in basic geometric objects.
4. Geometric transformations and continuous movements.
5. Rendering and scan conversion

Q3: Explain the stepwise transformation (step by step) of the two letters shown in the following figure into each other. (10 points)
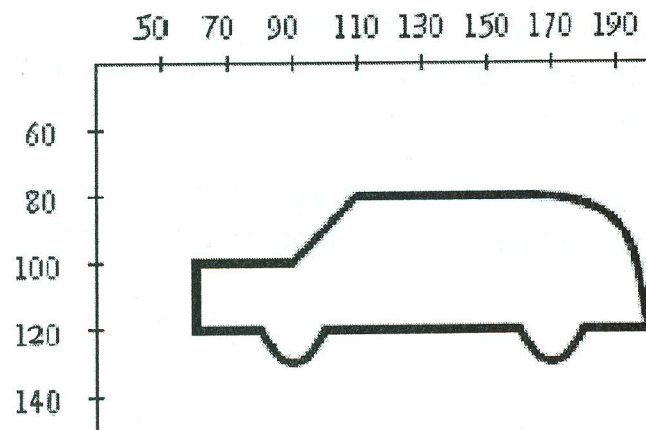

Q4: Use Java 2D to animate a beating heart that moves along a line in a window on the computer screen. (10 points)

Q5: Mark the interior of the polygons shown below according to the odd parity rule. (**10 points**)

Q6: Use a GeneralPath to draw the following car (Hint: Start at the lower left corner of the car). (**10 points**)

Good luck.   *Dr. Abdelhameed Fawzy (9/6/2012)*

الفرقة الرابعة
امتحان مادة: الرسم بالحاسب
الزمن: ٣ ساعات

جامعة المنصورة
كلية العلوم
قسم احصاء وعلوم الحاسب

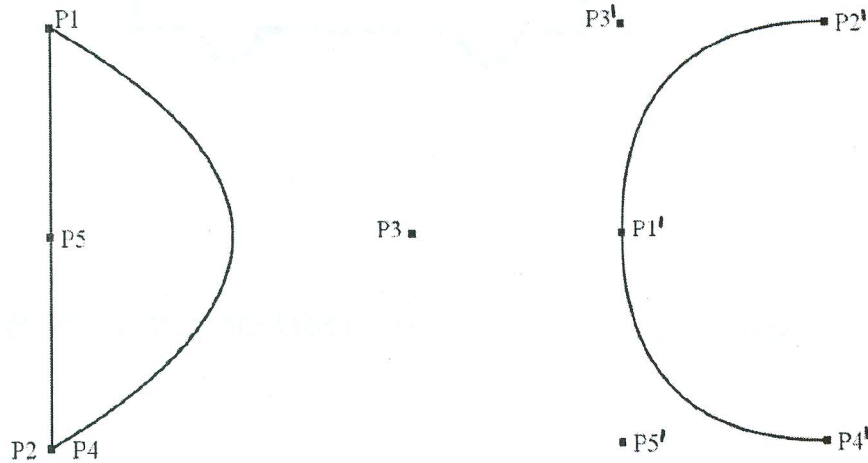Please answer the following questions:

Q1: Define the following: (**10 points**)

1. Java applications
2. Benefits of Programming in Java
3. Image Formation
4. Image processing
5. Image Processing Applications
6. Computer Graphics Application Fields
7. Applications of transformations
8. Antialiasing, draw an example.

Q2: Write the differences between the following: (**10 points**)

1. Raster graphics and vector graphics.
2. QuadCurve2D and CubicCurve2D.
3. Lines and areas in basic geometric objects.
4. Geometric transformations and continuous movements.
5. Rendering and scan conversion

Q3: Explain the stepwise transformation (step by step) of the two letters shown in the following figure into each other. (**10 points**)

Q4: Use Java 2D to animate a beating heart that moves along a line in a window on the computer screen. (**10 points**)

Q5: Mark the interior of the polygons shown below according to the odd parity rule. **(10 points)**

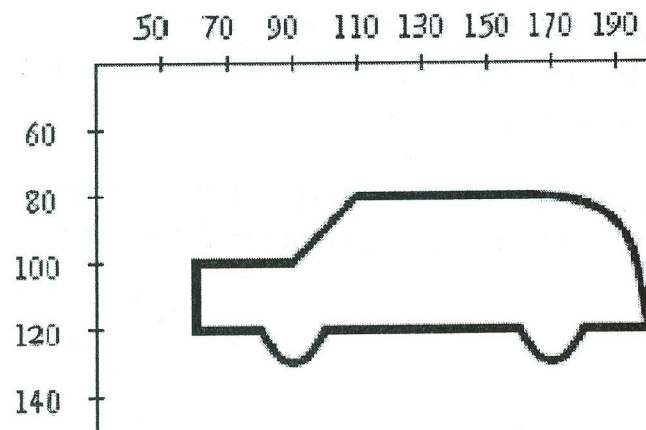**Q6**: Use a GeneralPath to draw the following car (Hint: Start at the lower left corner of the car). **(10 points)**

Good luck.   *Dr. Abdelhameed Fawzy (9/6/2012)*

جامعة المنصورة ـ كلية العلوم
قسم الرياضيات
التاريخ : ١٢ / ٦ / ٢٠١٢ م
الدرجة الكلية : ٨٠ درجة
الزمن : ساعتان

امتحان دور مايو ٢٠١٢ م
برنامج : احصاء و علوم الحاسب
المستوى : الرابع
اسم المقرر : سلاسل زمنية و تنبؤ
كود المادة : ر ٤٣٥

Answer the following questions:

[1] a) Consider two MA(1) processes $X_t = Z_t + \theta\, Z_{t-1}$, where $\{Z_t\} \sim IID\left(0\,,\, \sigma^2\right)$

one with $\theta = 4$ and the other with $\theta = \dfrac{1}{4}$

i) Show that these processes have the same autocorrelation .   (10 marks)

ii) Verify that only one of them is invertible process.   (10 marks)

b) Find the coefficients ψ_j, $j = 0\,,1\,,2\,,\ldots$ in the representation $X_t = \sum\limits_{j=0}^{\infty} \psi_j Z_{t-j}$ of

the causal ARMA $(1\,,1)$ process and use them to compute $\gamma(k)$ (10 marks)

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[2] a) Define the stationary and strictly stationary processes and show that a strictly stationary process with finite second moment is stationary process .   (10 marks)

b) For each of the following models, classify it as an ARMA $(p\,,q)$ process, and determine whether it is causal and / or invertible   (10 marks)

i) $X_t = Z_t - 1.3\, Z_{t-1} + 0.4\, Z_{t-2}$

ii) $X_t - 0.4\, X_{t-1} - 0.45\, X_{t-2} = Z_t + Z_{t-1} + 0.25\, Z_{t-2}$

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[3] a) Let $X_t = m_t + s_t + Y_t$ where m_t is a polynomial trend of degree k, s_t is a seasonal component with period length d and $\{Y_t\} \sim WN\left(0\,,\, \sigma^2\right)$

i) Define the operators ∇ and ∇_d, explain how they can be used to remove the trend and seasonality from the time series $\{X_t\}$, $t \in Z$ (10 marks)

ii) Outline the main steps of the classical decomposition method for estimating the trend and seasonal effects   (10 marks)

b) Consider the process $X_t = \varphi\, X_{t-1} + Z_t$ where $\{Z_t\} \sim WN\left(0\,,\, \sigma^2\right)$. Describe the stationary and causal properties of this process for different values of φ (10 marks)

Best wishes Dr. Faten Shiha

Mansoura university	2_nd term	المقرر : تحليل التباين (ر 434)
Faculty of science	2011/2012	الزمن : ساعتان
Math. Depart 4th year (stat., computer sci.)		التاريخ : 2012/6/5
	Final exam	

Answer the following questions

Q1: (27 marks)

For the observations in the following table

treatments	observations					
A	4	7	6	3		
B	7	8	6	6	5	4
C	5	6	7			

(a) Test the hypothesis that $H_0: \mu_1 = \mu_2 = \mu_3$ at level of significance $\propto = 0.05$ where
$$f_{0.05}(2,10) = 4.10$$

(b) Use Bartlett's test to test the homogeneity of variances at level of significance
$\propto = 0.01$ where
$$b_3(0.01,4) = 0.3165 \ , \ b_3(0.01,6) = 0.5149 \ , \ b_3(0.01,3) = 0.1672$$

Q2: 27 marks)

Four different education methods A, B, C and D are used for teaching the subject of mathematics to 24 students in primary school , the following table shows the marks for these students in the final exam of mathematics

Methods	Marks					
A	7	10	9	8	10	10
B	5	6	4	8	7	6
C	8	9	10	6	3	6
D	5	6	4	3	7	5

(a) With probability 95% test that education methods have the same effect, where
$$f_{0.05}(3,20) = 3.10$$

(b) Find the contrast sum of squares corresponding to the orthogonal contrasts
$$w_1 = \mu_1 + \mu_2 - 2\mu_3 \quad , \quad w_2 = \mu_1 + \mu_2 + \mu_3 - 3\mu_4$$

(c) Use t-test for comparing between the means of four different education methods,
where $t(0.05,20) = 2.845$

Q3: (26 marks)

Suppose that we are interested in the yields of 3 varieties A, B and C of potatoes using 3 different fertilizers over 3 different locations of equal size. The data in the following table are the yields for the 3 varieties of potatoes measured in 100 kg

Fertilizers	Location1	Location2	Location3
T_1	B	C	A
	13	21	11
T_2	A	B	C
	18	23	10
T_3	C	A	B
	12	20	19

" أطلب الورقة "

It is assumed that the various sources of variation do not interact using 0.05 level of significance , test the hypothesis there is no difference in the average yields of the 3 varieties of potatoes, where $f_{0.05}(2,2) = 19.0$

Good Luck

Mansoura University
Faculty of Science
Mathematics Department

Final exam
Second term
May 2012

4ᵗʰ level students (Mathematics / Statistics and computer Science programme)
Subject: Math 426 (Modelling and Simulations)

Date: 19 /06/2012   Time allowed: Two hours

Answer the following questions: Total marks: 80

Question one:

A) Define the following concepts: Logistic growth – predation – competition – mutualism. Give a discrete-time model for each of the first two concepts and a continuous-time model for each of the other two.   **(10 marks)**

B) Consider the following Volterra model for fish:

$$\frac{dU}{dt} = \alpha U - p E U - \gamma U V, \qquad \frac{dV}{dt} = e \gamma U V - q E U - \beta V$$

where p and q are the catchability coefficients for the prey U and the predator V, respectively, and the fishing takes place with constant effort E. Explain the model, find the steady states and discuss their stability.   **(10 marks)**

Question two:

A) Define the basic reproduction number.   **(5 marks)**

B) Construct an SIR model for an infection spreading in a closed population with constant size and study the possibility to vaccinate a proportion p of the newborns and then find the critical vaccination coverage level required to eliminate the infection.   **(15 marks)**

Question three:

A) Write down both the von Bertalanffy and Gompertz models for the tumour growth.   **(5 marks)**

B) Prove that in a large **spherical** tumour there is a shell of proliferating cells, whose thickness depends on the excess nutrient concentration above a threshold $(c_2 - c_1)$, how fast the nutrient is consumed **k** and how fast it diffuses **D** according to the relation $h^2 = 2D(c_2 - c_1)/k$, but not on the size of the tumour itself.   **(15 marks)**

Question four: **(20 marks)**

Assume that $p(a,t)$ is the age-specific density of individuals aged a at time t in a demographically stationary population, $\mu(a)$ is the per capita age-dependent death rate as well as the per capita age-dependent birth rate and $B(t) = p(0,t) = \int_0^\infty \mu(a)p(a,t)da$ is the total number of births at time t. Write down the age-dependent model that describes the population dynamics and use the method of characteristics to find $p(a,t)$.

Best regards,
The examiner
Dr. Muntaser Safan

El-Mansoura- Egypt	Final Exam. of 2nd term 2012.	المنصورة – مصر
Mansoura University	Program: 4th year.	جامعة المنصورة
Faculty of Science	Statistics and Computer Science	كلية العلوم
Mathematics Department	Subject: Graph Theory - Course Code: 412	قسم الرياضيات

Answer the following questions: **Marks**

1- **Find each of:**

   (i) All simple graphs with 4 vertices.   4

   (ii) A simple graph with 2 components , 10 vertices having: 4

       (a) maximal number of edges.   (b) minimal number of edges.

   (iii) An example of a connected graph with 2 n $(n \geq 2)$ vertices and no triangles and having: 4

       (a) Maximal number of edges.   (b)   Minimal number of edges.

   (iv) All nonisomorphic trees with 5 vertices.   4

   (v) (a) Find the maximal number of arcs $\left| E(D) \right|$ of an oriented digraph D with n vertices .   4

       (b) Find a regular graph G of order 1 with 2 n vertices .

2- **Prove.**

   (i) If there is an open walk between v_0 and v_n in a graph G, then there is a path between them.   5

   (ii) If v is a vertex in the complete graph K_n , then $K_n - v$ is the complete   5

       graph K_{n-1}, and then show that K_n is not bipartite, $\forall$ $n \geq 3$.

   (iii) Let G be a connected graph with n vertices, then   5

       G or G^c has a triangle for each $n \geq 6$.

   (iv) In any graph the number of vertices of odd degrees is even.   5

3- **(i)** Give the definition of a maximal planar graph. Let G = (V, E) be a maximal planar graph   10
       with $|\mathbf{V}| = n$ and $|\mathbf{E}| = m$. Prove that $m = 3n - 6$. and then show that K_5 is not planar.

   (ii) Give the definition of the rooted tree $T(v_0)$ and prove that indeg $v = 0$ or 1   10
       for each vertex v of T. And then use the rooted binary tree to sort and
       read the following list of words:
       "Please help me alphabetize the following list of words".

4- **(i)** Let $T = (V, E)$ be a tree with n vertices and u, v be two non-adjacent vertices.   7
       Prove that $T + u\,v$ has precisely one cycle C. If e is an edge of C, then the graph
       $T + u\,v - e$ is once again a tree.

   (ii) Prove that a graph G is regular of degree 2 $\Leftrightarrow$ each component of G is a cycle   7
       Give an example of regular graph of degree 2 with two components.

   (iii) Define the adjacency matrix A of a digraph D. Prove that the entry b_{ij} of A^2 6
       represents the number of all diwalks of length 2 from the vertex v_i to the vertex v_j.

Good luck.   **Total = 80**
Dr. M. H. Armanious

Mansoura University

Faculty of Science

Chemistry Department

Subject: Analytical Chemistry

Course: Environmental Chemistry

Course code: 413

Second term

4th level(Chem. Biology Geology and Botany)

Date: 2-6-2012

Time allowed: 2 hours

Full Mark: 60 Marks

Answer the Following Questions

Q1) (24 marks)

a- Explain, with examples, the effect of toxic chemicals on enzymes.

b- Explain the biochemical effects of <u>two only</u> of the following :

(a) Carbon monoxide

(b) Nitrogen oxides

(c) Sulphur dioxide

(d) Cyanide

and suggest antidotes for each

c- Explain the mechanism of action of insecticides.

Q2) (24 marks)

a- Explain biochemical methylation and illustrate propagation of Hg in food chain

b- What are the broad categories of water pollutants? Discuss

c- Give a concise account of the chemical speciation of (<u>two only</u>

(a)Hg   (b) Cu   (c) Pb   (d) As

in the environment

Q3) (12marks)

a- Define the following :

i) Trace elements   ii) Heavy metals   iii) speciation   iv) BOD

b- Write short notes on:

(i) Sanitary landfill method for waste disposal

(ii) Incineration method of waste disposal

Best wishes