Optimal 2D Boards Cutting Using Genetic Algorithm

انفال عبد المنعم فاضل**   د.سماء طليع عزيز*

الملخص

(bill of material) BOM

.

(search space)   (   )

BOM

.

/   /   )

.(/   /   /   /   /

.Autocad   oracle 9i   Visualbasic.net

Abstract

According to the development in computing industries and production Management ,in this research we focus on the design and application of of the main stages of production , a phase of cutting the 2D with standard

* مدرس/كلية علوم الحاسوب والرياضيات/جامعة الموصل

** طالبة ماجستير/كلية علوم الحاسوب والرياضيات/جامعة الموصل

measurements and virtual cutting , depending on the Bill Of Materials(BOM) of one product or the product order in order to achieve an optimum cutting and optimum parts distribution on the boards at less number of boards at less worst rate and showing it to technical engineer as a two-dimensional figure using autocad. Several attempts (probability)were tried to distribute the parts on the board at random in order to achieve an optimum distribution of BOM depending on the design and application of genetic algorithm which is one of the intelligent techniques with suggestion of cutting algorithm as a mechanism for virtual cutting characteristic of designed system, It can be applied in several plants (iron and steel /furniture/aluminum/ glass/ clothing/journals and magazines/containers/water tanks.), and also features the possibility of rotating some of the parts to achieve optimum cutting . The system was designed using visual basic .net , oracle 9i and autocad2007.

1-

.

.

.vb.net

BOM   (   )

9i

2007   BOM

BOM

2-   :

[6] (Np hard)

'

Buttom Left [8]

:

1- _____(_____):

2- _____(_____):

3-

(BOM)

CPU

.

2005 [9]

greedy

(guillotine) .

.

.

3- : -

: -

1- W,L

2- N BOM

3- i i=1 ....n li wi i

BOM

: -

1-

:

أ-   BOM

(1)   (244*122

cm) مقسومة على مجموع مساحات قطع الـ BOM التي من نفس نوع مادة الخام[7].

$$no.\,of\ bords = \frac{\sum_{i=1}^{n} li * wi}{L * W} \quad ....(1)$$

-   [1]

(1-a)

-   i   (   ) [1]

(1-b)

Part 1	Part3 Part 2
	Part 1
b	a

(1):

2-   90° (   )

:-

-   50%

‑

[5]

(   )

‑

‑

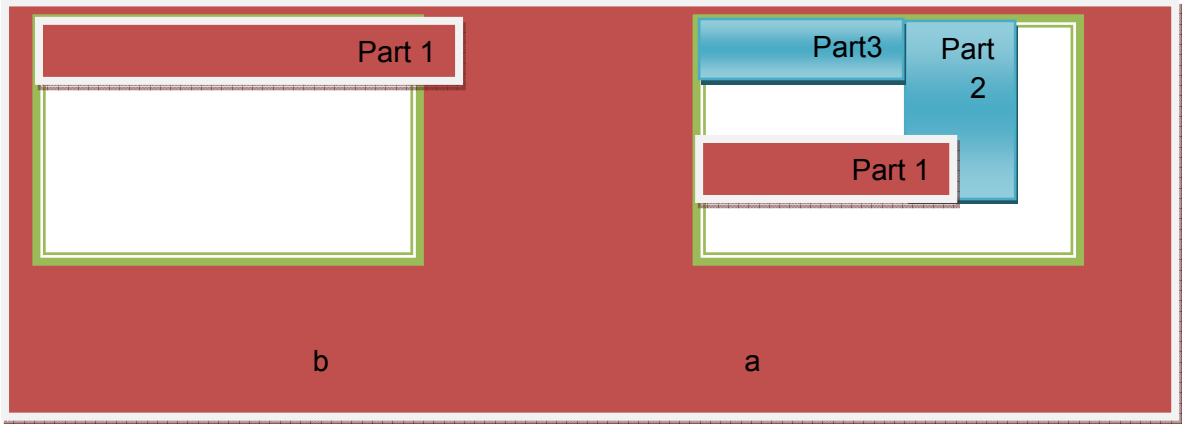(   )   3‑

(Vb.net/autocad /Oracle)   4‑

autocad &   [4]Oracle & Vb.net   Oracle & autocad

Vb.net

4‑هدف البحث :‑

‑:

1‑

2‑

3‑   )

(

BOM

4‑

5‑

6‑

7‑

5–   :-

BOM

:-

1–   [2]   VIEW

:

–   :   ,   .

–   :   ,   ,

,

–   :   ,   ,   ,   .

–   VIEW

BOM   view,   ,   ,   ,

(1)

Product_name	Teak length (cm)	Teak width (cm)	description	Quantity
3 drawers desk 150*80 cm	150	80	Desk top	11
	80	57	Desks back	3
	72	60	2 sides	1
	72	40	Back of 3 drawer	1
	56	40	Base	4
	47	2	2slices of drawer	6
	47	13	2 side of drawer	1
	40	10	Down plate	2
	40	4	Plate between 2drawer	3
	40	15	Back of drawer	3
	40	14	Front side drawer	1
	40	6		

				Upper plate	

BOM   (1)

2- :   R   (122*244)

122   244

(2)

	0	1	2	3	4	5																
0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	.	.	.	-1
2	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
3	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
.	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.
.	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.
123	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	.	.	.	-1

(122*244)   (2)

(-1)

.   (0)

(3)   (3) (1)

		0	1	2	3	4	5	6										
0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	.	.	.	-1
1	-1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	-1
2	-1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	-1
.	.	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	.
.	.	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	.
123	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	.	.	.	-1

R   (3)

C   :   3-

(1,1)   R

Y   X

.   CROM   :   4-

(4)   (1)

رمز تدوير القطعة 0 عدم تدوير	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
طول القطعة محجوزة	150	80	7	7	7	7	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	1	1	0	2	0	2	6	7	7	7	7	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0
عرض القطعة محجوزة	80	57	60	60	60	40	40	2	2	2	2	13	13	13	13	13	13	10	4	4	15	15	15	14	14	14	6

[633]

الجدول (4)الهيكل العام للكروموسوم

5-   :

Selection	Binary selection method
Crossover	Partially Mapped Crossover (PMX)
Mutation	Swap between 2genes
crossover Probability	75%
probability mutation	50%
Population size	20 chromosomes
Generation	25 population
Chromosome length	N يساوي عدد القطع لمنتج من نفس نوع الخشب

[3] [10]   (5)

(5)

6-   :-

:-

1-   :

.

(4)

BOM

(1),

.

_____ :

(Binary selection method)

C1={1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26 ,27}

C5={23,2,20,4,11,26,24,25,8,27,19,22,15,9,18,3,16,21,12,7,5,6,1,13,14,10,17}

9,24

24   10   9   1

27   25

C result=**{1,2,3,4,5,6,7,8,9**,8 ,27,19,22,15,9,18,3,16,21,12,7,5,6,1,13,**25,26 ,27**}

: -

1   1

23

23

:

C result={ 23,2,17,4,24,11,20,14,8,27,19,22,15,9,18,3,16,21,12,7,5,61,13,25,26,10}

(3,17)

C ={ 23,2,**17**,4,24,11,20,14,8,27,19,22,15,9,18,3,**16**,21,12,7,5,61,13,25,26,10}

C result={ 23,2, **16**,4,24,11,20,14,8,27,19,22,15,9,18,3, **17**,21,12,7,5,61,13,25,26,10}

.

: -   2-

‎. ‏   ‎: –‏

‎2-1-‏   ‎:‏

‎1-‏   ‎:‏

(fill in zero)

‎2-‏

‎(1)‏   ‎.‏

‎3-‏

‎4-‏

‎5-‏   ‎)‏

‎(1   5‏

‎6-‏

‎(1,1)‏

‎1   6‏

‎2-2-‏   ‎: –‏

‎: –‏
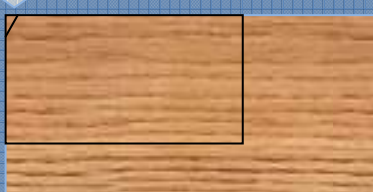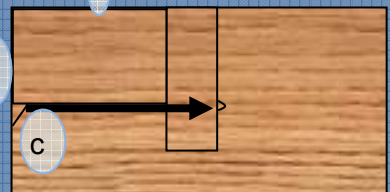
الشكل (2) انشاء الزوايا وتحديثها

7- (A, 2)

8- (B, 2)

9- :

- c   y   x

x   (C, 2)

-

(D, 2)

-

(E, 2)

10-   X   Y   F)

(2,

7-   :

:

1-

(3)
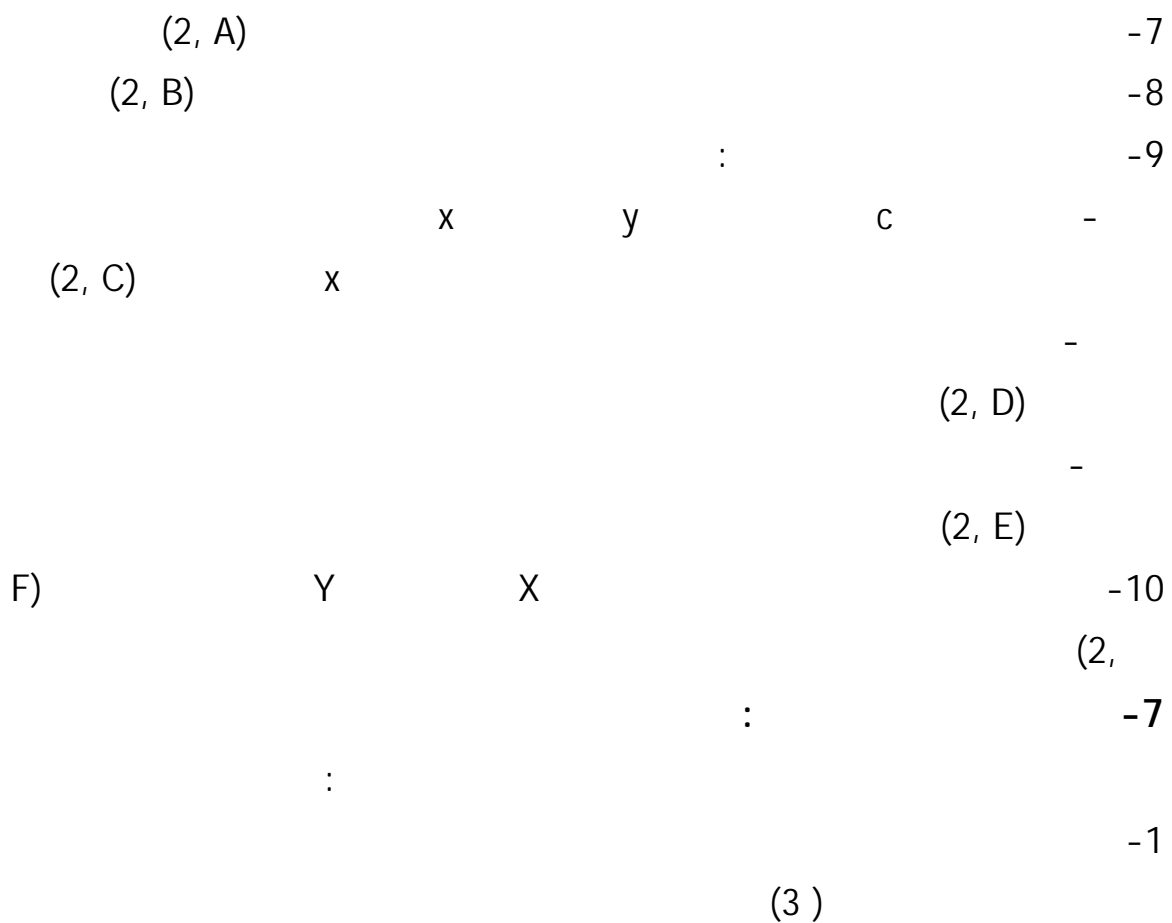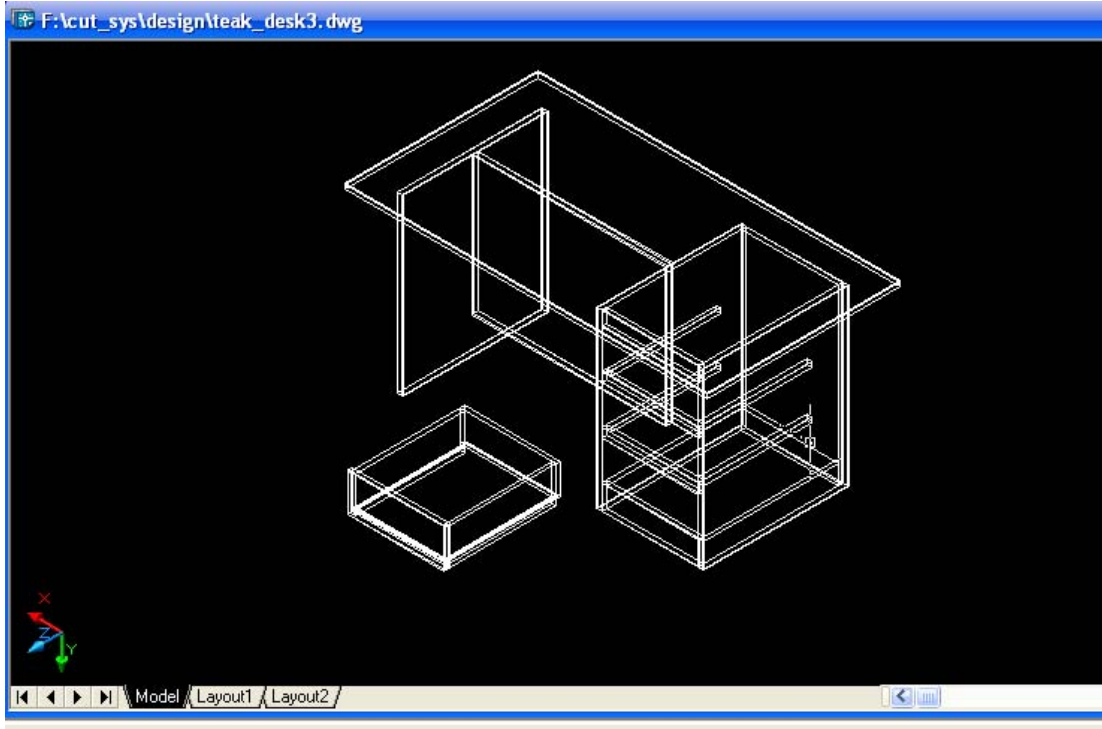
الشكل (**3**)شكل ثلاثي الابعاد لمنضدة خشب ذات ثلاثة مجرات

2-   BOM   (1)

3-

4-   .   (4)

Teak

(4)

8–

1-

(6)
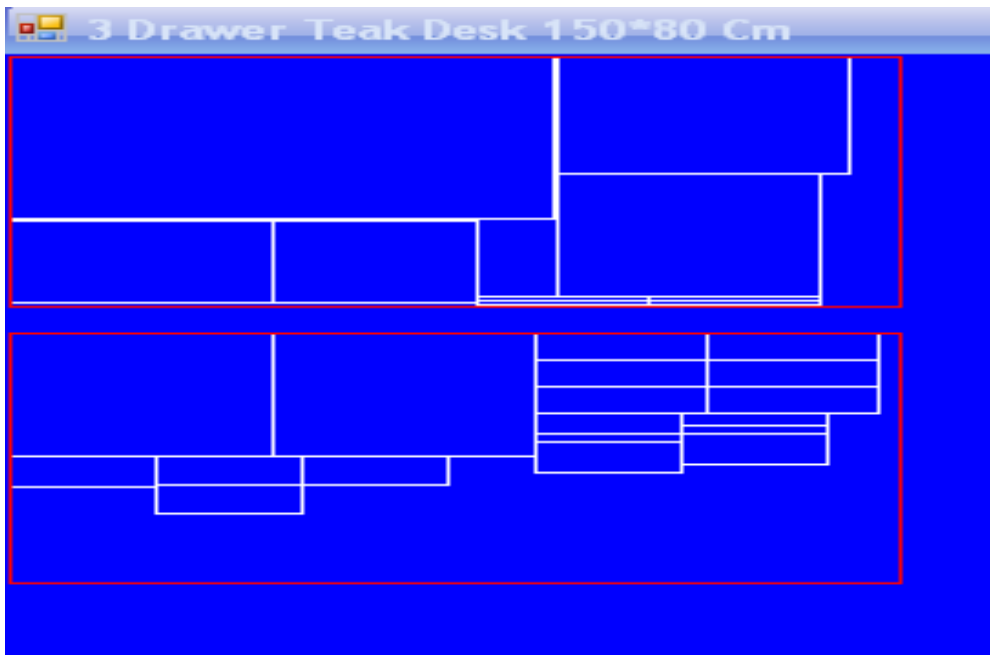
	MM:SEC:MS
VB.NET	00:00:25
	00:00:056
(20)	00:00:141
3drawer desck 150*80 *teak* *cm*	00:00:945
3drawer desck 150*80 teak cm	27:73:406
	00:17:836

(6)

BOM 2-

3-

4-

(7) 5-

	0%
	25%
	50%
	100%

(7)

[639]

9– :

1- (Fuzzy Logic

(Nural Networks

2-

3-

4- (,)

Refrence

1- Andreas Bortfeldt 2009 "A genetic algorithm for the two-dimensional strip
Packing problem with rectangular pieces" ,Department of Information
Systems, niversity of Hagen, Germany
2 -Donna K.,James W . 2001,oracle DBA fundamental ∏

3-Goldbery,D.E, 1989 "Gentic Algorithm in search,optimization,and achine
.learning" ,addisson_Wesley

4- Julia Case Bradley,Anita C.Millspaugh, 2005"programming in visual basic
.net",Mcgraw-hill-education

5- Laszlo Pal,2010 "A Genetic Algorithm for the Two-dimensional
Single Large Object Placement Problem" Sapientia University, Department of
Mathematics and Informatics,RO-530104 Miercurea-Ciuc, Romania
6- Mao Chen and Wenqi Huang,"A two-level search algorithm for 2D
rectangular packing problem",School of Computer Science, Huazhong
University of Science and Technology, 430074 Wuhan, People's Republic of
China Received 19 August 2006; received in revised form 21 December 2006;
accepted 11 April 2007 Available online 18 April 2007
7-N.Lesh,J.MARKS,A.McMahon,M.Mitzenmacher 2005 "new heuristic and
approaches to 2D Rectangular Strip packing" http://www.merl.com
8-R. Alvarez-Valdes ,F. Parreno and J.M. Tamarit 2007 "A GRASP
algorithm for constrained two-dimensional non-guillotine cutting problems
",University of Valencia, Department of Statistics and Operations Research,
Spain
9- William Benefold,Max Manfrin,Antonio Manuel, 2005 "Agentic algorithem
for 2D class cutting problem" TR/IRIDIA/13

10-yamaguchi A,1998 "Gentic algorithem for SU(N) gauae theory on alattic" ochanomizu university,2-1-2 otsuka Bunkyoku Tokyo,Japan