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```
500 IF B=1 THEN LOCATE 1+FG,1:COLOR 7:PRINT "the circular
representation of the ";N$;" set"
510 H=FG+9:G1=5+C/8:LOCATE H,G1:COLOR CC:PRINT  S(NM)
520 NEXT G
530 NEXT B
540 NEXT CC
550 GOSUB 580
560 NEXT FF
570 LOCATE 10 ,1:END
580 REM
590 FOR I=0 TO N
600 FOR J=0 TO N
610 SS(I,J)=QQ(I,J)
620 NEXT J
630 S(I)=Q(I)
640 NEXT I
650 RETURN
660 FOR I=0 TO N :FOR J=0 TO N
670 LOCATE I+2+FG,3*J+59:PRINT SS(I,J)
680 NEXT J
690 NEXT I
700 RETURN
710 REM
720 FOR J=0 TO N
730 IF SS(B,NM)=S(J) THEN H=J :BEEP:GOTO 750
740 NEXT J
750 RETURN
760 FOR I=0 TO N:J=CC
770 LOCATE I+2+FG,3*J+59:PRINT SS(I,J)
780 NEXT I
790 RETURN
800 REM
801 KP=0:QP=0
810 FOR J=1 TO KM-1
820 IF J=1 THEN SKIP=0 :GOTO 850
830 IF (KM MOD J)=0 THEN QP=QP+1:QW(QP)=J:GOTO 860 ELSE GOSUB 890
840 IF SKIP=0 THEN 850 ELSE QP=QP+1:QW(QP)=J:GOTO 860
850 KP=KP+1:ODD1(KP)=J
860 NEXT J
880 RETURN
890 FOR I=1 TO KM-1:FOR S=1 TO KM
900 IF J=I*QW(S) THEN SKIP=1 :GOTO 930 ELSE 910
910 NEXT S,I
920 SKIP=0
930 RETURN
1800 REM
1801 PP=0:
1810 FOR J=1 TO KM-1
1820 IF J=1 THEN SKIP=0 :GOTO 1850
1830 IF (KM MOD J)=0 THEN QS=QS+1:QW(QS)=J:GOTO 1860 ELSE GOSUB 1890
1840 IF SKIP=0 THEN 1850 ELSE QS=QS+1:QW(QS)=J:GOTO 1860
1850 PP=PP+1:ODD2(PP)=J
1860 NEXT J
1880 RETURN
1890 FOR I=1 TO KM-1:FOR S=1 TO QS
1900 IF J=I*QW(S) THEN SKIP=1 :GOTO 1930 ELSE 1910
1910 NEXT S,I
1920 SKIP=0
1930 RETURN
```

```
840 LOCATE I+2+FG,3*J+60:PRINT SS(I,J)
860 NEXT I
870 RETURN
```

The following program similar to the previous program but differ in the method of inputs. It requires only entering the modulo number of the set and it compute automatically the set members for the two groups. It also draws circular representation of the two groups.

```
10 COLOR 7,0
30 SCREEN 9:CLS:KEY OFF
40 INPUT "ENTER THE MOD OF THE IST SET ",K
55 DIM OO(10),QW(K),ODD1(K)
60 KM=K:GOSUB 800:N=KP
70 DIM S(N),SS(N+1,N+1)
80 FOR I=1 TO N
90 SS(0,I)=ODD1(I):SS(I,0)=ODD1(I):S(I)=ODD1(I)
100 NEXT I
110 FOR I=1 TO N
120 FOR J=1 TO N
130 SS(I,J)=S(I)*S(J) MOD K
140 NEXT J
150 NEXT I
160 INPUT "ENTER THE MOD OF THE SECOND SET ",L1
162 DIM ODD2(L1)
165 KM=L1:GOSUB 1800:M=PP
180 IF M<>N THEN  PRINT "the two groups is not isomorphic the
NO.";N;M:BEEP:END
190 DIM Q(20),QQ(M+1,M+1)
200 FOR J=1 TO M:QQ(0,J)=ODD2(J):QQ(J,0)=ODD2(J)  :Q(J)=ODD2(J)
210 NEXT J
220 FOR I=1 TO M
230 FOR J=1 TO M
240 QQ(I,J)=Q(I)*Q(J) MOD L1
250 NEXT J
260 NEXT I
270 B=8*ATN(1)/N:DIM X(N),Y(N),XX(M),YY(M)
280 CX=40:CY=60:R=35
290 FOR I=1 TO N
300 XI=CX+R*COS(I*B):YI=CY+R*SIN(I*B):X(I)=XI:Y(I)=YI
310 NEXT I
320 CLS
330 FOR FF=0 TO 200 STEP 200
340 FOR CC=1 TO N:C=(CC-1)*80
350 IF N<7 AND CC=1 AND FF=0 THEN FG=0:GOSUB 660
360 IF N<7 AND CC=1 AND FF=200 THEN FG=14:GOSUB 660
370 NM=CC
380 IF N<7 THEN COLOR CC:GOSUB 760
390 LINE(CX+C-R-5,CY-R-5+FF)-(CX+C+R+4,CY+R+4+FF),CC,B
400 FOR B=1 TO N
410 GOSUB 710:SOUND 37+B+CC,1
420 XB=X(B)+C:YB=Y(B)+FF:XH=C+X(H):YH=FF+Y(H)
430 LINE (XB,YB)-(XH,YH),B
440 BB=8*ATN(1)/360
450 FOR G=1 TO 360
460 XG=CX+C+R*COS(G*BB)
470 YG=CY+FF+R*SIN(G*BB)
480 PSET (XG,YG)
490 IF FF=200  THEN FG=14 :N$="Second" ELSE FG=0:N$="First"
```

```
170 IF M<>N THEN PRINT "the two groups is not isomorphic ": BEEP:GOTO
160
180 DIM Q(20),QQ(M+1,M+1)
190 FOR J=1 TO M:INPUT Q(J):QQ(0,J)=Q(J):QQ(J,0)=Q(J)
200 NEXT J
210 FOR I=1 TO M
220 FOR J=1 TO M
230 QQ(I,J)=Q(I)*Q(J) MOD L1
240 NEXT J
250 NEXT I
260 B=8*ATN(1)/N:DIM X(N),Y(N),XX(M),YY(M)
270 CX=40:CY=60:R=35
280 FOR I=1 TO N
290 XI=CX+R*COS(I*B):YI=CY+R*SIN(I*B):X(I)=XI:Y(I)=YI
300 NEXT I
310 CLS
320 FOR FF=0 TO 200 STEP 200
330 FOR CC=1 TO N:C=(CC-1)*80
335 IF N<7 AND CC=1 AND FF=0 THEN FG=0:GOSUB 630
340 IF N<7 AND CC=1 AND FF=200 THEN FG=14:GOSUB 630
350 NM=CC
355 IF N<7 THEN COLOR CC:GOSUB 830
360 LINE(CX+C-R-5,CY-R-5+FF)-(CX+C+R+4,CY+R+4+FF),CC,B
370 FOR B=1 TO N
380 GOSUB 680:SOUND 37+B+CC,1
390 XB=X(B)+C:YB=Y(B)+FF:XH=C+X(H):YH=FF+Y(H)
400 LINE (XB,YB)-(XH,YH),B
410 BB=8*ATN(1)/360
420 FOR G=1 TO 360
430 XG=CX+C+R*COS(G*BB)
440 YG=CY+FF+R*SIN(G*BB)
450 PSET (XG,YG)
460 IF FF=200 THEN FG=14: N$=" second" ELSE FG=0:N$="first"
470 IF B=1 THEN LOCATE 1+FG, 1:COLOR 7:PRINT "the circular
representation of the ";N$;" set"
480 H=FG+9:G1=5+C/8:LOCATE H,G1:COLOR CC:PRINT  S(NM)
490 NEXT G
500 NEXT B
510 NEXT CC
520 GOSUB 550
530 NEXT FF
540 LOCATE 10 ,1:END
550 REM
560 FOR I=0 TO N
570 FOR J=0 TO N
580 SS(I,J)=QQ(I,J)
590 NEXT J
600 S(I)=Q(I)
610 NEXT I
620 RETURN
630 FOR I=0 TO N :FOR J=0 TO N
640 LOCATE I+2+FG,3*J+60:PRINT SS(I,J)
650 NEXT J
660 NEXT I
670 RETURN
680 REM
690 FOR J=0 TO N
700 IF SS(B,NM)=S(J) THEN H=J :BEEP:GOTO 720
710 NEXT J
720 RETURN
830 FOR I=0 TO N:J=CC
```

```
1760 FOR I=1 TO PL
1770 GL(1+K-I,1)=UJ(I)
1780 NEXT I
1790 FOR I=1 TO HH
1800 GL(PL+I,1)= UD(I)
1810 NEXT I
1820 FOR I=1 TO PL  +HH:GL(I,2)=I:NEXT
1830 FOR I=1 TO PL   :GL(1+K-I,2)=I:NEXT
1840 RETURN
1850 REM
1860 FOR J=1 TO K
1870 IF S(CC)=GL(J,1) THEN HY=GL(J,2)
1880 NEXT J
1890 RETURN
1900 FOR J=1 TO I-1
1910 IF UJ(J)=INVERSEIEA(I+1) THEN QY=1:GOTO 1940 ELSE QY=0
1920 IF UI(J)=INVERSEIEA(I+1) THEN QY=1:GOTO 1940 ELSE QY=0
1930 NEXT J
1940 RETURN
5210 IF N=2*INT(N/2) THEN :GOTO 5250
5211 FOR J=1 TO N-1
5215 IF J=1 THEN SKIP=0 :GOTO 5222
5220 IF (N MOD J)=0 THEN  QP=QP+1:QW(QP)=J:GOTO 5230 ELSE GOSUB 5300
5221 IF SKIP=0 THEN 5222 ELSE QP=QP+1:QW(QP)=J:GOTO 5230
5222 KP=KP+1:ODD(KP)=J
5230 NEXT J
5240 KIND$="odd"
5250 RETURN
5300 FOR I=1 TO N-1:FOR S=1 TO N
5310 IF J=I*QW(S) THEN SKIP=1 :GOTO 5350 ELSE 5320
5320 NEXT S,I
5340 SKIP=0
5350 RETURN
```

The previous program deals with prim number , even Iea and Iee numbers, and odd numbers.

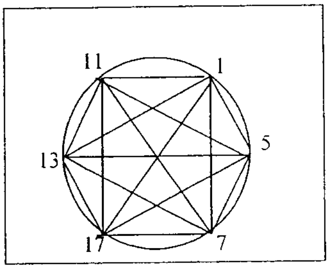
The following Program draws the circular representation of two groups. The program requires equality of the number of elements in two groups. It using of colors in drawing to each element, and we can distinguish the isomorphic groups by total similarity of drawing.

```
1 COLOR 7,0
20 SCREEN 9:CLS: KEY OFF
30 INPUT "ENTER THE MOD OF THE IST SET ",K
40 INPUT "ENTER THE NUMBER OF IST GROUP SET ?",N
50 DIM S(N),SS(N+1,N+1)
60 PRINT "ENTER THE ELEMENT OF THE SET    "
70 FOR I=1 TO N
80 INPUT S(I):SS(0,I)=S(I):SS(I,0)=S(I)
90 NEXT I
100 FOR I=1 TO N
110 FOR J=1 TO N
120 SS(I,J)=S(I)*S(J) MOD K
130 NEXT J
140 NEXT I
150 INPUT "ENTER THE MOD OF THE SECOND SET ",L1
160 INPUT "ENTER THE ELEMENTS OF SECOND GROUP SET  ";M
```

```
1180 IF N<5 AND CC=1 AND FF=0 THEN FG=0:GOSUB 1440
1190 IF N<5 AND CC=1 AND FF=120 THEN FG=14:GOSUB 1440
1200 IF CU>8 AND CC<16 THEN FF=100:FG=7
1210 IF CU>16 AND CC<24 THEN FF=200:FG=15
1220 IF C=1 AND CU>8   THEN FF=100:FG=10
1230 IF C=1 AND CU>16  THEN FF=200:FG=11
1240 NM=CC:GOSUB 1850
1250 IF N<5 THEN GOSUB 1550 :COLOR HY
1260 LINE(CX+C-R-5,CY-R-5+FF)-(CX+C+R+4,CY+R+4+FF),HY,B
1270 BB=8*ATN(1)/360
1280 FOR G=1 TO 360
1290 XG=CX+C+R*COS(G*BB)
1300 YG=CY+FF+R*SIN(G*BB)
1310 PSET (XG,YG),HY
1320 NEXT G
1330 IF CU=1 THEN LOCATE 1+FG,1:COLOR 7:PRINT "The Circular
representation of the ";N$;" elements"
1340 H=FG+8  :G1=5+ABS(C/8)MOD 79::LOCATE H,G1:COLOR HY :PRINT  S(NM)
1350 FOR B=1 TO N
1360 GOSUB 1490:SOUND 37+B+CC,1
1370 XB=X(B)+C:YB=Y(B)+FF:XH=C+X(H):YH=FF+Y(H)
1380 LINE (XB,YB)-(XH,YH),HY
1390 NEXT B
1400 NEXT CC
1410 IF CU=N THEN GOTO 1430
1420 IF CC<8 THEN 1160 ELSE 1150
1430 LOCATE 16 ,1:END
1440 FOR I=0 TO N :FOR J=0 TO N
1450 LOCATE I+2+FG,3*J+60::PRINT SS(I,J)
1460 NEXT J
1470 NEXT I
1480 RETURN
1490 REM
1500 FOR J=0 TO N
1510 IF SS(B,NM)=S(J) THEN H=J:GOTO 1540
1520 NEXT J
1530 STOP
1540 RETURN
1550 FOR I=0 TO N:J=CC
1560 LOCATE I+2+FG,3*J+60:PRINT SS(I,J)
1570 NEXT I
1580 RETURN
1590 DIM GL(K,2)
1600 FOR I=1 TO K
1610 IF INVERSEIEA(I)=INVERSEJEA(I) THEN HH=HH+1:GL(K-
HH,1)=INVERSEIEA(I)
1620 NEXT I
1630 HK=N-HH-1:DIM UI(K ),UJ(K ),UD(HH):LL=0
1640 FOR I=1 TO K
1650 IF INVERSEIEA(I+1)=INVERSEJEA(I+1) THEN
LL=LL+1:UD(LL)=INVERSEIEA(I+1)
1660 NEXT I:LL=0
1670 FOR I=1 TO K
1680 IF INVERSEIEA(I+1)=INVERSEJEA(I+1) THEN 1720
1690 GOSUB 1900 :IF QY=1 THEN GOTO 1720 ELSE PL=PL+1
1700 UI(PL)=INVERSEJEA(I+1)
1710 UJ(PL)=INVERSEIEA(I+1)
1720 NEXT I
1730 FOR I=1 TO PL
1740 GL(I,1)= UI(I)
1750 NEXT I
```

```
610 IF B(I,J)=B(1,J) THEN IDENTYEE=B(I,J) :LOCATE 1,70:PRINT
"I=";IDENTYEE:GOTO 640
620 NEXT J
630 NEXT I
640 FOR I=2 TO L
650 FOR J=2 TO L
660 IF A(I,J)=IDENTYEA THEN
INVERSEIEA(I)=A(1,J):INVERSEJEA(I)=A(I,1):GOTO 680
670 NEXT J
680 NEXT I
690 FOR I=2 TO L
700 FOR J=2 TO L
710 IF B(I,J)=IDENTYEE THEN
INVERSEIEE(I)=B(1,J):INVERSEJEE(I)=B(I,1):GOTO 730
720 NEXT J
730 NEXT I
740 GOSUB 1590
750 LOCATE 2 ,70:PRINT "El"
760 LOCATE 2 ,75:PRINT "Inv"
770 FOR I=2 TO L:
780 IF TT$="2" THEN 810 ELSE 790
790 LOCATE I ,70 :PRINT INVERSEJEA(I);"Inv" :LOCATE I,60:PRINT GL(I-
1,2):LOCATE I,65:PRINT GL(I-1,1)
800 LOCATE I ,76 :PRINT INVERSEIEA(I);:GOTO 830
810 LOCATE I ,70 :PRINT INVERSEJEE(I);"Inv"
820 LOCATE I ,76 :PRINT INVERSEIEE(I);
830 NEXT I
840 LOCATE 20,1:INPUT "do you want graph (Y/N)",ANS$
850 IF ANS$="y" OR ANS$="Y" THEN GOTO 1000
860 IF ANS$="n" OR ANS$="N" THEN END
870 IF ANS$<>="n" OR ANS$="N" OR ANS$= "y" OR ANS$="Y"  THEN BEEP
:GOTO 840
880 IF N=2*INT(N/2) THEN GOTO 890 ELSE GOTO 930
890 FOR I=1 TO 100
900 IF 2^I=N THEN KIND$="Iee":GOTO 930
910 NEXT I
920 KIND$="Iea"
930 PRINT KIND$
940 RETURN
950 FOR J=2 TO N-1
960 IF (N MOD J)=0 THEN  GOTO 990 ELSE 970
970 NEXT J
980 KIND$="prim"
990 RETURN
1000 COLOR 7,0
1010 DIM OO(10)
1030 N=NUM :PRINT N
1040 DIM S(N+1),SS(N+1,N+1)
1050 FOR J=1 TO N+1:FOR I=1 TO N+1
1060 SS(I-1,J-1)=A(I,J):S(I)=A(1,I)
1070 NEXT I,J
1080 FOR I=1 TO N+1:S(I-1)=A(1,I) :NEXT
1090 B=8*ATN(1)/N:DIM X(N),Y(N),XX(M),YY(M)
1100 CX=40:CY=60:R=35
1110 FOR I=1 TO N
1120 XI=CX+R*COS(I*B):YI=CY+R*SIN(I*B):X(I)=XI:Y(I)=YI
1130 NEXT I
1140 CLS :IF N<=5 THEN KK=0 ELSE KK=200
1150 IF CC>8 THEN FF=FF+200
1160 FOR CC=1 TO N:C=((CC MOD 8))*80
1170 CU=CU+1
```

```
70 FOR I=1 TO N
80 IF I=1 THEN C=C+1 :NX(1)=I:GOTO 140
90 IF I MOD 2=0 THEN 150
100 B=INT(N/I)
110 IF N=B*I THEN C=C+1:MX(C)=I:GOTO 150
120 GOSUB 480
130 IF SKIP=0 THEN 140 ELSE 150
140 NUM=NUM+1 :NX(NUM)=I
150 NEXT I
160 REM 6/4/ 1988
170 CLS:KEY OFF:SCREEN 9:LOCATE ,,0
180 K=NUM:MAJOR=N/2+1
190 L=K+1
200 DIM A(L,L),B(L,L)
201 IF KIND$="odd" THEN 202 ELSE 210
202 FOR I=1 TO K:A(I+1,1)=ODD(I):A(1,I+1)=ODD(I):NEXT I:GOTO 260
210 IF KIND$="prim" THEN 220 ELSE 230
220 FOR I=1 TO N-1:A(I+1,1)=I:A(1,I+1)=I     :NEXT I:KIND$="Iee":GOTO
260
230 IF KIND$="Iee" THEN 240 ELSE 250
240 FOR I=2 TO L:A(I,1)=NX(I-1):A(1,I)=A(I,1):NEXT I:GOTO 260
250 FOR I=2 TO L:A(I,1)=NX(I-1):A(1,I)=A(I,1):B(1,I)=(MAJOR*A(I,1))
MOD N:B(I,1)=(MAJOR*A(1,I)) MOD N:NEXT I
260 FOR J=2 TO L :FOR S=2 TO L
270 A(J,S)=A(1,S)*A(J,1) MOD N
280 B(J,S)=B(1,S)*B(J,1) MOD N
290 NEXT S
300 NEXT J
310 CLS:S=0
320 IF KIND$="Iee" THEN TT$="1": GOTO 350
330 PRINT "chose (1) for odd"
340 INPUT "        (2) for even";TT$:CLS
350 IF K>24 THEN PRINT "The number of elements=";K;"which is greater
than 24":STOP
355 FOR I=1 TO L:FOR J=1 TO L
360 IF TT$="2" THEN 370 ELSE 380
370 AIJ=B(I,J):GOTO 390
380 AIJ=A(I,J)
390 LOCATE J,3*I:PRINT AIJ
400 NEXT J:NEXT I
410 CX=3*8*L+16:CY=1*14*L+8
420 LOCATE 1,4:PRINT "*"
430 FOR X=16 TO CX STEP 24
440 LINE (X,0)-(X,CY-8),5:NEXT X
450 FOR Y=0 TO CY STEP 14
460 LINE (16,Y)-(CX,Y),5:NEXT Y
470 GOTO 530
480 FOR J=2 TO C
490 IF I MOD MX(J)=0 THEN SKIP=1:GOTO 510 ELSE SKIP=0
500 NEXT J
510 REM
520 RETURN
530 FOR I=2 TO L
540 FOR J=2 TO L
550 IF A(I,J)=A(1,J) THEN IDENTYEA=A(I,J) :LOCATE 1,70:PRINT
"I=";IDENTYEA:GOTO 580
560 NEXT J
570 NEXT I
580 IF TT$="1" THEN GOTO 640
590 FOR I=2 TO L
600 FOR J=2 TO L
```



All graphs in one circle

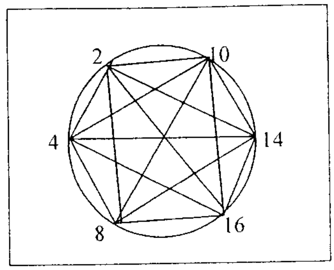


Figure (18)

From all graphs of groups we can conclude that:

- The identity element is empty circle.
- Every element and his inverse have the same shape path but divers in arrows directions[2]; one of them is clockwise and the other is anti-clock wise.
- Every closed path is cycle sub group from the group and its element is a generator element.
- The closure property appears from every element has two arrows one of them is in and the other is out.
- The graph of all tables in one circle is the magic circle.
- The graph of two isomorphic groups is the same path shapes.
- Finally the shape of additive groups are symmetrical, cyclic group, and its generator draws regular shape (in last example is hexagon).

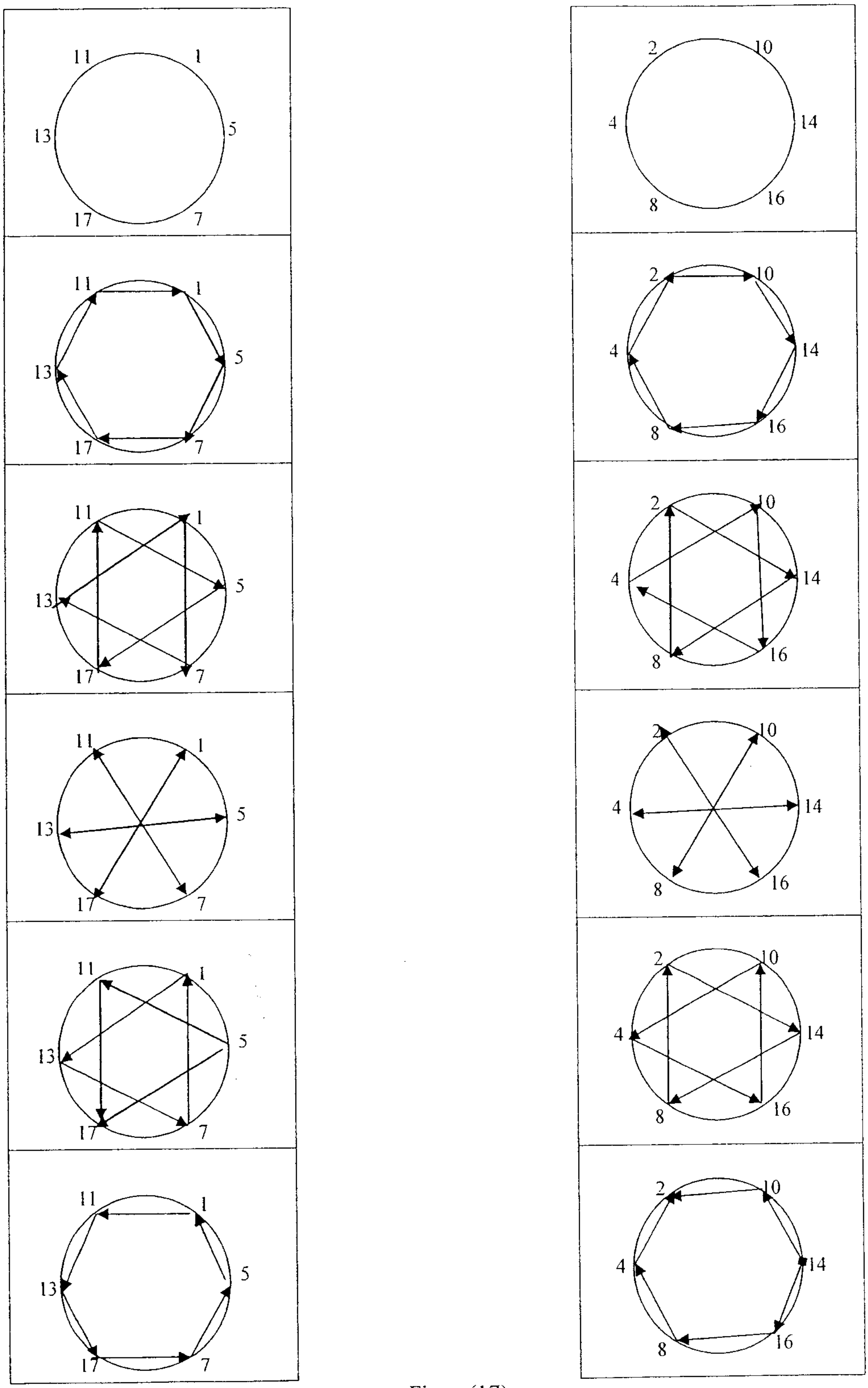
This activity and others concluded in unit to be applied on eight-grade student in 1986. The student attracted by such activity and such approach help them to achieve many difficult concepts such: identity element, inverse element, subgroups, and cyclic groups and isomorphism (10).

Another study applied in 1994 students in secondary industry schools using modulo system activity. This study aimed to help the students in designing the astral Islamic plates. The study concluded that the group theory and modulo systems activities help the student in their design and developed their creativeness as appeared by Torrance figural test.

The following program determine the elements of the group when we enter the modulo number, and determine the inverse of each element, and put it in standard form, and finally draw the circular representation of the elements. We can see that the element and his inverse is drawn by the same color and since there is no arrow we can see every element and its inverse have the same representation

```
10 CLS
20 INPUT "Enter the modulo ",N
30 DIM
NX(N),MX(N),INVERSEIEE(N),INVERSEJEE(N),EVEN(N),ODD(N),INVERSEIEA(N),
INVERSEA(N),INVERSEJEA(N),QW(N)
40 GOSUB 950:IF KIND$="prim" THEN NUM=N-1 :GOTO 160
50 GOSUB 880
60 GOSUB 5210 :IF KIND$="odd" THEN NUM=KP:GOTO 180
```

[2] We can imagine the elements and his inverses with respect to addition in the set of integral numbers as they divers only in sign



Figure(17)

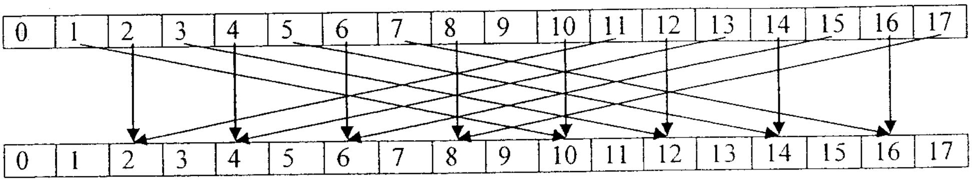


Figure (12)

1		3		5		7		11		13		15		17

10		12		14		16		2		4		6		8

Figure(13) (10 x {1,3,5,7,11,13,15,17}

The tables of the two groups are:

*	1	5	7	11	13	17
1	1	5	7	11	13	17
5	5	7	17	1	11	13
7	7	17	13	5	1	11
11	11	1	5	13	17	7
13	13	11	1	17	7	5
17	17	13	11	7	5	1

*	10	14	16	2	4	8
10	10	14	16	2	4	8
14	14	16	8	10	2	6
16	16	8	4	14	10	2
2	2	10	14	4	8	16
4	4	2	10	8	16	14
8	8	6	2	16	14	10

Figure (14)

Now we put them in standard form

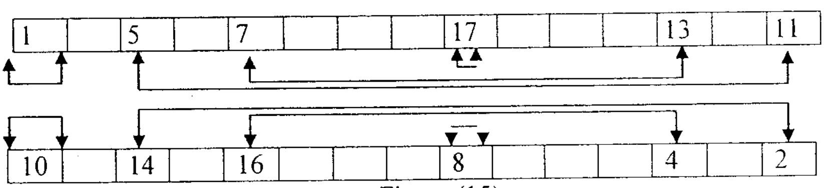


Figure (15)

*	1	5	7	17	13	11
1	1	5	7	17	13	11
5	5	7	17	13	11	1
7	7	17	13	11	1	5
17	17	13	11	1	5	7
13	13	11	1	5	7	17
11	11	1	5	7	17	13

*	10	14	16	8	4	2
10	10	14	16	8	4	2
14	14	16	8	6	2	10
16	16	8	4	2	10	14
8	8	6	2	10	14	16
4	4	2	10	14	16	8
2	2	10	14	16	8	4

Figure (16)

Now we graph the circular representation of the two tables

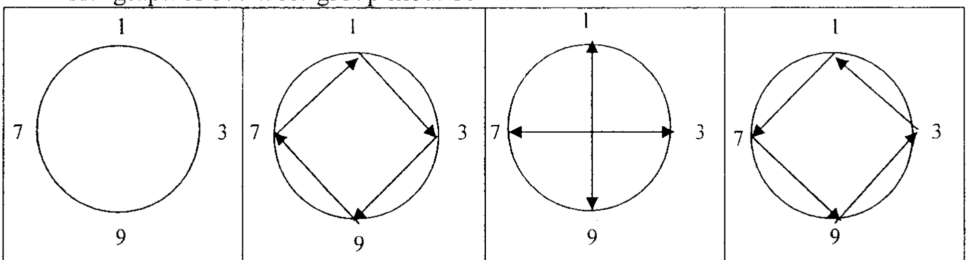
We reject the number 0 because it hasn't an inverse with respect to the multiplication operation. From the graph we see number 5 (10/2) it is in the middle (and connected by zero) , we find two groups the first one has elements {1,3,7,9 }[it's identity is 1] and the elements of the second one its are {2,4,6,8} [it's identity is 6]

*	1	3	9	7
1	1	3	9	7
3	3	9	7	1
9	9	7	1	3
7	7	1	3	9

*	6	2	4	8
6	6	2	4	8
2	2	4	8	6
4	4	8	6	2
8	8	6	2	4

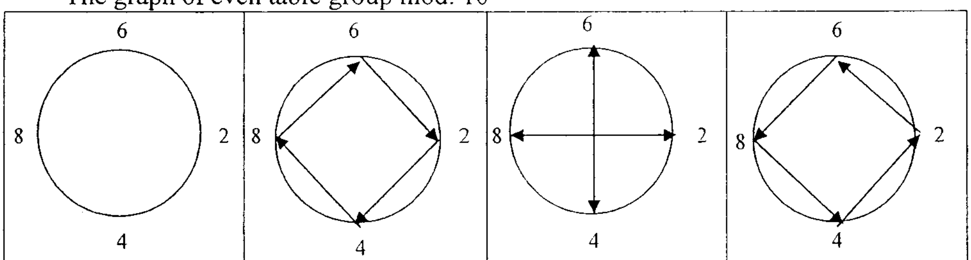
Figure (10)

The graph of odd table group mod. 10



Connection of element 1 i.e. 1 x{1,3,9,7}	Connection of element 3 i.e. 3 x{1,3,9,7}	Connection of element 9 i.e. 9 x{1,3,9,7}	Connection of element 7 i.e. 7 x{1,3,9,7}

The graph of even table group mod. 10



Connection of element 6 i.e. 6 x{6,2,4,8}	Connection of element 2 i.e. 2 x{6,2,4,8}	Connection of element 4 i.e. 4 x{6,2,4,8}	Connection of element 8 i.e. 8 x{6,2,4,8}

Figure (11)

Example (3):

Deduce the even and odd group elements of modulo 18 and put it in standard form

Solution:

Since the number 18 is I2o we expect two isomorphic groups; one of them is odd elements and the other is even elements. We use the formula to find the major element which is F(18) = 10, then the identity element the group of even elements is 8 and the odd number which prim to 18 is {1, 5 , 7 ,17 , 11} if we multiply them by 10 we have the set {10, 14 , 16 , 8, 4 ,2} which is the even set constitute a group under multiplication mod. 10

Now we compute the table for the set as in the following table

*	1	3	5	7	9	11	13	15
1	1	3	5	7	9	11	13	15
3	3	9	15	5	11	1	7	13
5	5	15	9	3	13	7	1	11
7	7	5	3	1	15	13	11	9
9	9	11	13	15	1	3	5	7
11	11	1	7	13	3	9	15	5
13	13	7	1	13	5	15	9	3
15	15	13	11	11	7	5	3	1

Figure (7)

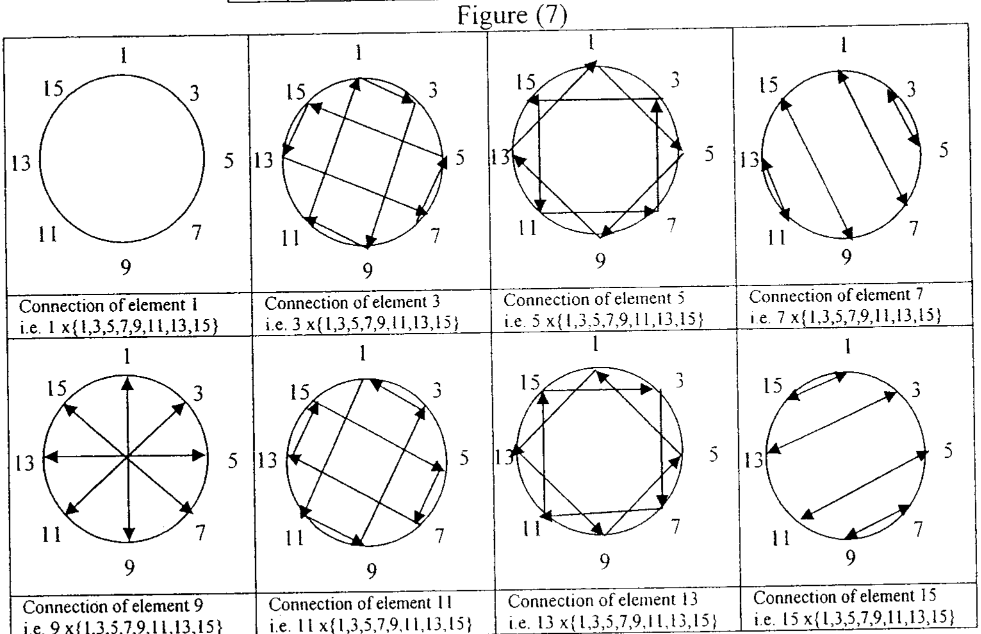


Figure (8)

I20 modulo system:

When modulo system is I_{eo} numbers we use the same formula to determine the odd group elements, but now we find another even elements group which is isomorphic to the odd group elements. And we use the odd elements and multiply them by the number (n/2 +1) we deduce even group elements

Example:

Deduce the elements of odd group and even groups elements from modulo system 10

Solution:

F(10)=10/2 + 1 =6 , which is identity element for even group

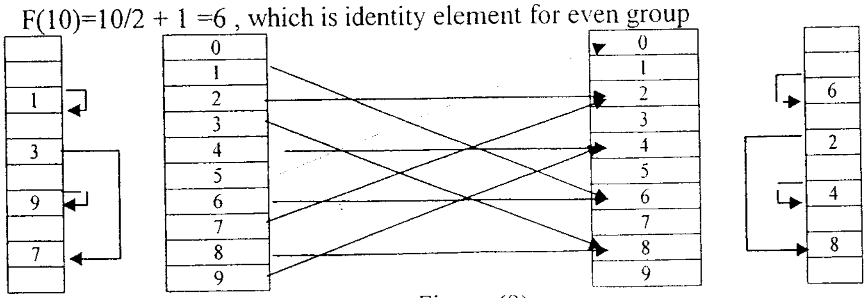
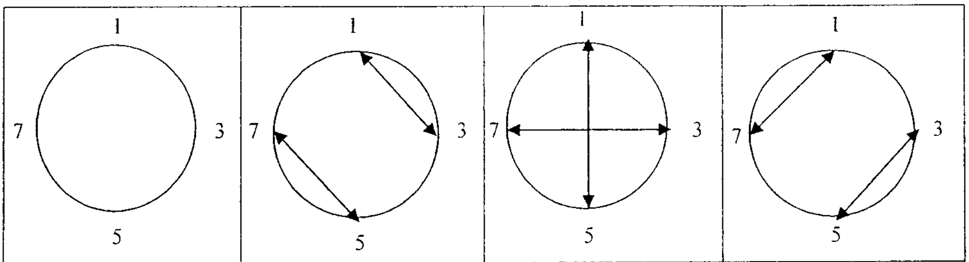


Figure (9)

The number 8 is Iee element and from Euler's equation his group order is 4 $(2^3) = 2^3 - 2^2 = 4$. Now we graph the circular graph of group



Connection of element 1 i.e. 1 x{1,3,5,7}	Connection of element 3 i.e. 3 x{1,3,5,7}	Connection of element 5 i.e. 5 x{1,3,5,7}	Connection of element 7 i.e. 7 x{1,3,5,7}

Figure (4)

We can see all I_{ee} mod. Have one group of odd elements as in the following example:

Example (2): deduce the elements of group in system of modulo 16

Solution:

We first use the formula F(16) to determine the major number F(16)=16/2 +1 = 9

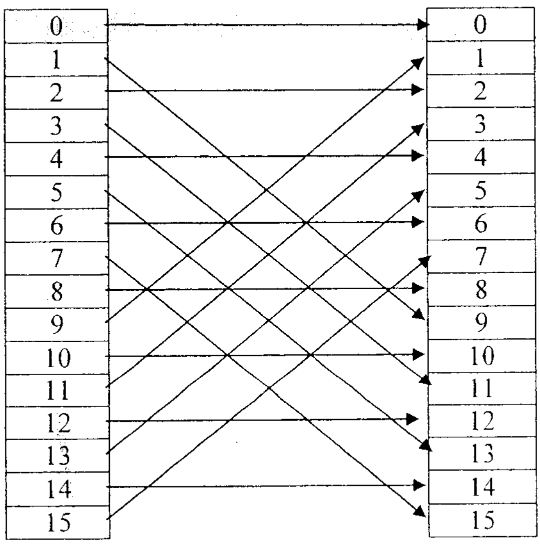


Figure (5)

As in example (1) we reject the parallel horizontal lines we find the set is {1,3,5,7,11,13,15} whose order is 8

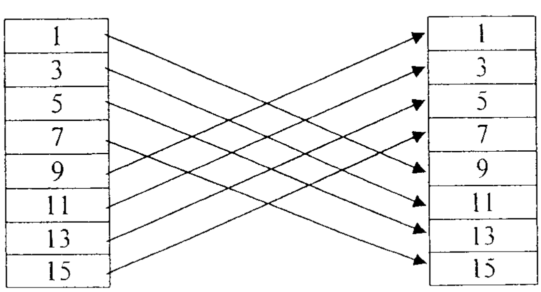


Figure (6)

- Circular representation of a group elements is dividing the circumference into n equally numbers of arcs where n is the number of group elements , and write elements of the group at the start of each arc , and connect every two elements such that :

a x K $\Rightarrow$ K where K is the group set a is any element in the group.

z

We know the number 1 as identity element for multiplication operation for systems, which contain that number, but there are some sets, which consist of even number only such as 2,4,6,8 with respect to mod. 10, that set does not contain the element 1.

Now let's use the map F(n) to deduce the identity element of some systems which are Iee modulo and the elements of the group itself.

I_{ee} Systems:

Example (1) :

Deduce the group elements of the system mod (8) with respect to multiplication operation.

Solution:

F(n)=n/2 + 1

F(8)=8/2 + 1 = 5

Now the number 5 drive us to determine the group elements of the system (I_8*) after excluding the zero element :

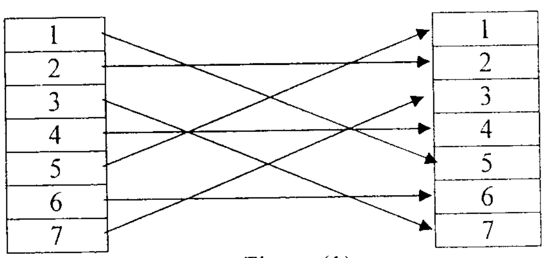


Figure (1)

Now we reject all elements connected by parallel horizontal lines[1], we see the other constitute a group of order 4.

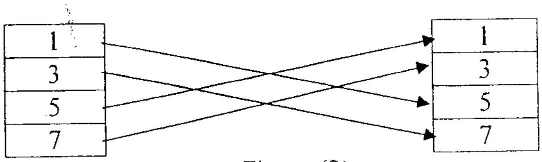


Figure (2)

*	1	3	5	7
1	1	3	5	7
3	3	1	8	5
5	5	7	1	3
7	7	5	3	1

Figure (3)

[1] Its connect the element by it self

Investigation of Some Properties of Table Group from the Circular Representation of its Elements

Professor.: Nazla H. Kheder
Faculty of Education
Ein Schames University
Professor: Mahmoud Ibrahim Badr
Faculty of Education
Benha University

Introduction:

The group theory is one of the most important topics in abstract algebra, and so widely taught for secondary school students.

Historical Notes:

The Group Theory appeared for first time in the field of algebraic equation in the eighteenth century, but the ancient Egyptian and Babylonian People used modulo system of 24, 60. The modulo system mod 12 was known lately as a cycle of day and night.

The story of group theory started when some scientists tried to solve the algebraic equations. They succeeded in solving the equations whose orders 1,2,3,4 by laws, but the fifth order equation appeared as a puzzle.

The first try to solve it was made by ***Lagrange***, who transformed it to sixth order equation, but his method to permute the roots of the equation was the start point for ***Galios*** who used the name group for the first time, but the axiom of the group itself appeared gradually. In 1814 ***Seravois*** introduced for the first time the commutative law. ***Hamilton*** introduced the associative law and quadratic group as example for non commutative group.

Kayley did the first study in group theory. And the first one who used modulo system was Gauss.

Klein, Poincare and Soves Lie applied the group theory in physics.

The Modulo Systems:

The arithmetic modulo system played an important part in development of group theory, so in this article we discuss how to use the map $F(n) = n/2 + 1$ where n is natural number in determining the identity element and the group from some modulo systems and deduce some properties of group from circular representation of the group elements on a circle.

- The map $F(n) = n/2 + 1$ where $I \Rightarrow I$, I is positive natural number and zero
- I_e is even integer number
- I_o is odd integer
- I_{eo} is even integer having odd factors for example 6=2. 3, 10 = 2 x 5
- I_{2o} is even integer but it represent as 2 x O where O is odd number for example 10=2 x 5 , 18=2 x 9 , 22=2 x 11
- I_{ee} is even integer having even factor only , for example $8 = 2^3$