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1 *****
2 *   BRESENHAM'S CIRCLE ALGO   *
3 *                               *
4 *   BY MARC GOLOMBECK       *
5 *                               *
6 *   VERSION 1.1 / 22.03.2017 *
7 *                               *
8 *   VERSION WHICH CAN BE CALLED *
9 *   FROM BASIC VIA THE FOLLOWING *
10 *   CALL-COMMAND:           *
11 *                               *
12 *   CALL 24576,XP,YP,RA,HC   *
13 *                               *
14 *   XP: X-CENTER (0..279)    *
15 *   YP: Y-CENTER (0..191)    *
16 *   RA: RADIUS OF CIRCLE (0-255) *
17 *   HC: HCOLOR (0..7)       *
18 *                               *
19 *   A SCREEN RANGE CHECK IS PER- *
20 *   FORMED BEFORE EACH CIRCLE *
21 *   PIXEL IS DRAWN TO AVOID A *
22 *   WRAP-AROUND EFFECT      *
23 *                               *
24 *****
25 *
26 *           ORG   $6000
27 *
28 X       EQU   $EB      ; CURRENT POSITION ON ARC
29 Y       EQU   $ED      ; X = $EB, $EC / Y = $ED
30 DX      EQU   $06      ; BRESENHAM X-STEP
31 DY      EQU   $07      ; BRESENHAM Y-STEP
32 FEHLER  EQU   $08      ; BRESENHAM ERROR TERM
33 RADIUS  EQU   $09      ; CIRCLE RADIUS
34 XM      EQU   $FA      ; CIRCLE CENTER X, $FA $FB
35 YM      EQU   $FC      ; CIRCLE CENTER Y
36 XDRAW   EQU   $1A      ; DRAWING POSITION X
37 YDRAW   EQU   $09      ; DRAWING POSITION Y
38 XT      EQU   $FD      ; TWO'S COMPLEMENT OF X,Y
39 YT      EQU   $FF      ; FOR SUBTRACTION
40 *
41 PREAD   EQU   $FB1E    ; READ PADDLE - NOT YET USED
42 WAIT    EQU   $FCA8    ; WAIT-ROUTINE
43 HCOLOR  EQU   $F6F0    ; SET HCOLOR
44 HGR     EQU   $F3E2    ; SWITCH TO HGR
45 HPLOT   EQU   $F457    ; PLOT DOT AT X,Y
46 HPOSN   EQU   $F411    ; POSITION HGR-CURSOR
47 CHKCOM  EQU   $DEBE
48 FRMNUM  EQU   $DD67
49 GETADR  EQU   $E752
50 LINNUM  EQU   $50
51 COMBYTE EQU   $E74C
52 *
53 * EVAL USER INPUT AND INIT VARIABLES
54 *
6000: 20 BE DE 55 ENTRY   JSR   CHKCOM   ; READ X POSITION
6003: 20 67 DD 56         JSR   FRMNUM   ; EVAL FORMULA
6006: 20 52 E7 57         JSR   GETADR   ; PUT FAC TO LINNUM
6009: A5 50    58         LDA   LINNUM   ; READ OUT RESULTS
600B: 85 FA    59         STA   XM       ; X-POS CIRCLE CENTER
600D: A5 51    60         LDA   LINNUM+1
600F: 85 FB    61         STA   XM+1
62 *
6011: 20 4C E7 63         JSR   COMBYTE  ; READ Y POSITION
6014: 86 FC    64         STX   YM       ; ONLY A 1 BYTE-VALUE
65 *
6016: 20 4C E7 66         JSR   COMBYTE  ; READ RADIUS

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6019: 86 09      67          STX    RADIUS      ; ONLY A 1 BYTE-VALUE
68 *
601B: 20 4C E7  69          JSR    COMBYTE    ; READ HCOLOR TO X-REG
601E: 20 F0 F6  70          JSR    HCOLOR      ; SET HCOLOR
71 *
6021: A5 09      72  INITVAR  LDA    RADIUS      ;
6023: 85 08      73          STA    FEHLER    ; FEHLER = RADIUS
6025: 85 EB      74          STA    X          ; INIT X = RADIUS
6027: A9 00      75          LDA    #$00
6029: 85 ED      76          STA    Y          ; INIT Y = 0
602B: 85 EC      77          STA    X+1      ; INIT X-HIGHBYTE = 0
78 *
79 * DRAW THE FIRST PIXELS SO THAT THE CIRCLE HAS NO HOLES
80 *
602D: 20 13 61  81          JSR    CALCXTYT   ; GET -X AND -Y FOR PLOT
6030: 20 2E 61  82          JSR    SETPIX1   ; DRAW FOUR CORNER PIXELS
83 *
84 * LOOP FOR THE OCTANTS
85 *
6033: A5 ED      86  LOOP     LDA    Y
6035: C5 EB      87          CMP    X
6037: 90 01      88          BCC    LOOPGO    ; IF Y < X THEN LOOP
6039: 60         89  EXIT     RTS          ; CIRCLE IS FINISHED - EXIT!
90 *
91 * CALC BRESENHAM'S ALGORITHM
92 *
603A: A5 ED      93  LOOPGO   LDA    Y
603C: 0A         94          ASL          ; Y*2
603D: 69 01      95          ADC    #$01     ; +1
603F: 85 07      96          STA    DY       ; DY = Y*2 + 1
6041: E6 ED      97          INC    Y        ; Y = Y + 1
98 *
6043: A5 07      99          LDA    DY       ; CALCULATE TWO'S COMPLEMENT
6045: 49 FF     100         EOR    #$FF     ; Y IS ALWAYS > 0
6047: 18         101         CLC
6048: 69 01     102         ADC    #$01
604A: 65 08     103         ADC    FEHLER
604C: 85 08     104         STA    FEHLER    ; FEHLER = FEHLER - DY
604E: 10 19     105         BPL    DOPLOTS   ; IF FEHLER >= 0 THEN DO PLOT!
6050: A5 EB     106  STEPX   LDA    X          ; STEP IN NEGATIVE X-DIR
6052: 0A         107         ASL          ; X*2
6053: 49 FF     108         EOR    #$FF
6055: 18         109         CLC
6056: 69 01     110         ADC    #$01     ; -X*2 TWO'S-COMPLEMENT
6058: 69 01     111         ADC    #$01     ; -X*2 + 1
605A: 85 06     112         STA    DX       ; DX = 1 - X*2
605C: C6 EB     113         DEC    X          ; X = X - 1
605E: A5 06     114         LDA    DX       ; DX TWO'S COMPLEMENT
6060: 49 FF     115         EOR    #$FF
6062: 18         116         CLC
6063: 69 01     117         ADC    #$01
6065: 65 08     118         ADC    FEHLER
6067: 85 08     119         STA    FEHLER    ; FEHLER = FEHLER - DX
120 *
121 * CALC -X AND -Y
122 *
6069: 20 13 61  123  DOPLOTS  JSR    CALCXTYT
124 *
125 * PLOT CIRCLE OCTANTS
126 *
127 * H PLOT XM+X, YM+Y - 1ST OCTANT
606C: 18         128         CLC          ; XM+X
606D: A5 FA     129         LDA    XM
606F: 65 EB     130         ADC    X
6071: 85 1A     131         STA    XDRAW
6073: A5 FB     132         LDA    XM+1

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6075: 65 EC      133          ADC      X+1
6077: 85 1B      134          STA      XDRAW+1
135 *
6079: 18         136          CLC              ; YM+Y
607A: A5 FC      137          LDA      YM
607C: 65 ED      138          ADC      Y
607E: 85 09      139          STA      YDRAW
140 *
6080: 20 F1 60   141          JSR      PLOTPIX
142 *
143 * HPLOT XM-X, YM+Y - 2ND OCTANT
6083: 18         144          CLC              ; XM-X
6084: A5 FA      145          LDA      XM
6086: 65 FD      146          ADC      XT
6088: 85 1A      147          STA      XDRAW
608A: A5 FB      148          LDA      XM+1
608C: 65 FE      149          ADC      XT+1
608E: 85 1B      150          STA      XDRAW+1
151 *
152 * YM+Y ALREADY IN YDRAW
153 *
6090: 20 F1 60   154          JSR      PLOTPIX
155 *
156 * HPLOT XM-X, YM-Y - 3RD OCTANT
157 *
158 * XM-X ALREADY IN XDRAW!
159 *
6093: 18         160          CLC              ; YM-Y
6094: A5 FC      161          LDA      YM
6096: 65 FF      162          ADC      YT
6098: 85 09      163          STA      YDRAW
164 *
609A: 20 F1 60   165          JSR      PLOTPIX
166 *
167 * HPLOT XM+X, YM-Y - 4TH OCTANT
609D: 18         168          CLC              ; XM+X
609E: A5 FA      169          LDA      XM
60A0: 65 EB      170          ADC      X
60A2: 85 1A      171          STA      XDRAW
60A4: A5 FB      172          LDA      XM+1
60A6: 65 EC      173          ADC      X+1
60A8: 85 1B      174          STA      XDRAW+1
175 *
176 * YM-Y ALREADY IN YDRAW!
177 *
60AA: 20 F1 60   178          JSR      PLOTPIX
179 *
180 * HPLOT XM+Y, YM+X - 5TH OCTANT
60AD: 18         181          CLC              ; XM+Y
60AE: A5 FA      182          LDA      XM
60B0: 65 ED      183          ADC      Y
60B2: 85 1A      184          STA      XDRAW
60B4: A5 FB      185          LDA      XM+1
60B6: 69 00      186          ADC      #$00      ; DON'T FORGET CARRY-FLAG!
60B8: 85 1B      187          STA      XDRAW+1
188 *
60BA: 18         189          CLC              ; YM+X
60BB: A5 FC      190          LDA      YM
60BD: 65 EB      191          ADC      X
60BF: 85 09      192          STA      YDRAW
193 *
60C1: 20 F1 60   194          JSR      PLOTPIX
195 *
196 * HPLOT XM-Y, YM+X - 6TH OCTANT
60C4: 18         197          CLC              ; XM-Y
60C5: A5 FA      198          LDA      XM

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60C7: 65 FF 199          ADC   YT
60C9: 85 1A 200          STA   XDRAW
60CB: A5 FB 201          LDA   XM+1
60CD: 69 FF 202          ADC   #$FF
60CF: 85 1B 203          STA   XDRAW+1
204 *
205 * YM+X ALREADY IN YDRAW
206 *
60D1: 20 F1 60 207          JSR   PLOTPIX
208 *
209 * HPLOT XM-Y, YM-X - 7TH OCTANT
210 *
211 * XM-Y ALREADY IN XDRAW!
212 *
60D4: 18 213          CLC           ; YM-X
60D5: A5 FC 214          LDA   YM
60D7: 65 FD 215          ADC   XT
60D9: 85 09 216          STA   YDRAW
217 *
60DB: 20 F1 60 218          JSR   PLOTPIX
219 *
220 * HPLOT XM+Y, YM-X - 8TH OCTANT
60DE: 18 221          CLC           ; XM+Y
60DF: A5 FA 222          LDA   XM
60E1: 65 ED 223          ADC   Y
60E3: 85 1A 224          STA   XDRAW
60E5: A5 FB 225          LDA   XM+1
60E7: 69 00 226          ADC   #$00
60E9: 85 1B 227          STA   XDRAW+1
228 *
229 * YM-X ALREADY IN YDRAW!
230 *
60EB: 20 F1 60 231          JSR   PLOTPIX
232 *
60EE: 4C 33 60 233          JMP   LOOP           ; BACK TO THE LOOP-START
234 *
235 *****
236 * SUBROUTINE PLOTPIXEL *
237 *****
238 *
60F1: A5 09 239 PLOTPIX LDA   YDRAW           ; CHECK IF YDRAW > 191
60F3: C9 C0 240          CMP   #$C0           ; Y-VALUE OUT OF RANGE NO PLOT!
60F5: B0 1B 241          BCS   ENDPLOT
60F7: A5 1B 242          LDA   XDRAW+1       ; CHECK IF XDRAW+1 > 1
60F9: C9 02 243          CMP   #$02           ; X-VALUE OUT OF RANGE NO PLOT!
60FB: B0 15 244          BCS   ENDPLOT
60FD: A5 1B 245          LDA   XDRAW+1       ; CHECK IF XDRAW+1 = 0
60FF: C9 00 246          CMP   #$00
6101: F0 06 247          BEQ   DOPLT
6103: A5 1A 248          LDA   XDRAW           ; IF XDRAW+1 = 1 THEN CHECK
6105: C9 18 249          CMP   #$18           ; IF XDRAW > 24 -> X-VALUE
6107: B0 09 250          BCS   ENDPLOT       ; OUT OF RANGE DO NOT PLOT!
6109: A6 1A 251 DOPLT  LDX   XDRAW
610B: A4 1B 252          LDY   XDRAW+1
610D: A5 09 253          LDA   YDRAW
610F: 20 57 F4 254          JSR   HPLOT
6112: 60 255 ENDPLOT RTS
256 *
257 *****
258 * SUBROUTINE CALC -X AND -Y *
259 *****
260 *
261 * CALC -X
262 *
6113: A5 EB 263 CALCXYT LDA   X
6115: 49 FF 264          EOR   #$FF

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6117: 18          265          CLC
6118: 69 01      266          ADC  #$01
611A: 85 FD      267          STA  XT
611C: A5 EC      268          LDA  X+1
611E: 49 FF      269          EOR  #$FF
6120: 69 00      270          ADC  #$00
6122: 85 FE      271          STA  XT+1          ; XT = -X
272 *
273 * CALC -Y
274 *
6124: A5 ED      275          LDA  Y
6126: 49 FF      276          EOR  #$FF
6128: 18         277          CLC
6129: 69 01      278          ADC  #$01
612B: 85 FF      279          STA  YT          ; YT = -Y
280 *
612D: 60         281          RTS          ; DONE
282 *
283 *****
284 * SUBROUTINE PLOT FIRST PIXELS *
285 *****
286 *
287 * HPLOT XM+X (=RADIUS), YM
288 *
612E: 18         289 SETPIX1  CLC          ; SET XDRAW = XM+X
612F: A5 FA      290          LDA  XM
6131: 65 EB      291          ADC  X
6133: 85 1A      292          STA  XDRAW
6135: A5 FB      293          LDA  XM+1
6137: 65 EC      294          ADC  X+1
6139: 85 1B      295          STA  XDRAW+1
296 *
613B: A5 FC      297          LDA  YM          ; SET YDRAW = YM
613D: 85 09      298          STA  YDRAW
299 *
613F: 20 F1 60  300          JSR  PLOTPIX    ; HPLOT
301 *
302 * HPLOT XM-X (=RADIUS), YM
303 *
6142: 18         304          CLC          ; SET YDRAW = XM-X
6143: A5 FA      305          LDA  XM
6145: 65 FD      306          ADC  XT
6147: 85 1A      307          STA  XDRAW
6149: A5 FB      308          LDA  XM+1
614B: 65 FE      309          ADC  XT+1
614D: 85 1B      310          STA  XDRAW+1
311 *
312 * YDRAW ALREADY CALCULATED
313 *
614F: 20 F1 60  314          JSR  PLOTPIX    ; HPLOT
315 *
316 * HPLOT XM, YM+X (=RADIUS)
317 *
6152: A5 FA      318          LDA  XM          ; SET XDRAW = XM
6154: 85 1A      319          STA  XDRAW
6156: A5 FB      320          LDA  XM+1
6158: 85 1B      321          STA  XDRAW+1
322 *
615A: 18         323          CLC          ; SET YDRAW = YM+X
615B: A5 FC      324          LDA  YM
615D: 65 EB      325          ADC  X
615F: 85 09      326          STA  YDRAW
327 *
6161: 20 F1 60  328          JSR  PLOTPIX    ; HPLOT
329 *
330 * HPLOT XM, YM-X (=RADIUS)

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331 *
332 * XDRAW ALREADY CALCULATED!
333 *
6164: 18      334      CLC
6165: A5 FC   335      LDA    YM
6167: 65 FD   336      ADC    XT
6169: 85 09   337      STA    YDRAW
338 *
616B: 20 F1 60 339      JSR    PLOTPIX    ; HPLOT
340 *
616E: 60      341      RTS          ; DONE, NOW START LOOP
342 *
616F: 19      343      CHK
344 *
```

--End assembly, 368 bytes, Errors: 0