Chapter 10 Control Break Logic

Objectives

Upon completion of this chapter you will be able to:

- Describe the write, roll, zero, and save steps used in control break processing,
- Design and code a program using single level control break processing,
- Design and code a program using multiple level control break processing, and
- Design and code a program using control break processing to produce a summary report.

Introduction

In each of our programs thus far any counts and/or totals were shown at end of job only. In this chapter we will learn to produce **subtotals** as well. Subtotals can be done at any number of levels, and are the result of **control break processing**. In this chapter we will introduce single level and multiple level control break processing. No new instructions are introduced in this chapter.

Throughout this chapter we will make use of the course offerings file, Offer. Dat. Our first program, Offer10a.MLC, lists selected fields from each record in that file. Page break logic is included. There is a limit of ten detail lines per page. The output is shown below, and the complete program listing is found on the next page. There is nothing new here: the program is given so as to provide a starting point for our discussion.

	COURSE	OFFERINGS	Page	1
Sem	Course	Section	Teacher	
W92	EG102	1	732	
W92	MA107	1	218	
W92	PE151	1	574	
F92	AC101	1	218	
F92	BU101	1	218	
F92	EG101	1	732	
F92	EG101	2	732	
F92	MA101	1	626	
F92	MA101	2	626	
F92	PE151	1	574	
	COURSE	OFFERINGS	Page	
			- 5 -	
Sem	Course	Section	Teacher	
W93	EG102	1	854	
W93	MA101	1	626	
W93	MA107	1	626	
W93	PE151	1	574	

```
PRINT NOGEN
*****************
      FILENAME: OFFER10A.MLC
      AUTHOR : Bill Qualls *
SYSTEM : PC/370 R4.2 *
REMARKS : Produce list of course offerings for all *
* semesters. Includes page break logic.
      START 0
      REGS
BEGIN
       BEGIN
      WTO 'OFFER10A ... Begin execution'
       BAL R10, SETUP
MAIN
       EQU
       CLI EOFSW, C'Y'
       BE EOJ
BAL R10, PROCESS
B MAIN
EOJ
      EQU
       BAL
            R10,WRAPUP
           'OFFER10A ... Normal end of program'
       WTO
      RETURN
************
      SETUP - Those things which happen one time only, *
SETUP EQU *
      ST R10, SVSETUP
OI OFFER+10, X'08'
                           PC/370 ONLY - Convert all
                           input from ASCII to EBCDIC
       OI REPORT+10, X'08'
                           PC/370 ONLY - Convert all
                            output from EBCDIC to ASCII
       OPEN OFFER
       OPEN REPORT
       BAL R10, READ
L R10, SVSETUP
BR R10
      BR
      ***********
      HDGS - Print headings.
****************
      EQU *
HDGS
       ST R10, SVHDGS
       AP PGS,=P'1' Add 1 to page count MVC HDPGS,=X'40202120' Edit pattern for page count
       ED HDPGS, PGS Move page count to heading PUT REPORT, FORMFEED PC/370 ONLY
       PUT
            REPORT, HD1
       PUT REPORT, HD2
       PUT REPORT, HD3
PUT REPORT, HD4
       ZAP LNS,=P'0'
                           Reset line count to zero
          R10, SVHDGS
       L
       BR
            R10
*************
      PROCESS - Those things which happen once per record. *
******************
PROCESS EQU *
       ST R10, SVPROC
BAL R10, CHKLNS
       BAL R10, FORMAT
```

```
R10,WRITE
       BAL
       BAL
           R10, READ
           R10, SVPROC
       L
      BR
          R10
    *********
      READ - Read a record.
*****************
READ EQU *
      ST R10,SVREAD
GET OFFER,IREC Read a single offer record
      В
           READX
ATEND
      EQU
      MVI EOFSW, C'Y'
READX
      EQU
           R10, SVREAD
      L
      BR
          R10
**********
      CHKLNS - Check lines printed. Full page?
CHKLNS EQU *
          R10, SVCHKLNS
      ST
          LNS, MAXLNS
       CP
       BL
           CHKLNSX
      BAL R10, HDGS
CHKLNSX EQU *
          R10, SVCHKLNS
R10
      BR
*************
      FORMAT - Format a single detail line.
FORMAT EQU *
      ST R10, SVFORM
MVC OREC (40), BLANKS
          OSEM, ISEM Semester
OCID, ICID Course ID
OSECT, ISECT Section number
       MVC
       MVC
       MVC OSECT, ISECT
      MVC OTID, ITID
MVC OCRLF, WCRLF
                          Teacher ID PC/370 Only
           R10,SVFORM
       L
      BR
          R10
 ***********
      WRITE - Write a single detail line.
WRITE EQU *
           R10, SVWRITE
       ST
       PUT REPORT, OREC
                      Write report line
       AΡ
           LNS,=P'1'
          LNS,-: :
R10,SVWRITE
       L
          R10
      BR
      WRAPUP - Those things which happen one time only, *
* after all records have been processed.
WRAPUP EQU *
           R10,SVWRAP
       ST
       CLOSE OFFER
       CLOSE REPORT
       WTO 'OFFER10A ... Course list on REPORT.TXT'
           R10, SVWRAP
       BR R10
```

```
LTORG
***********
       File definitions
************
OFFER DCB LRECL=18, RECFM=F, MACRF=G, EODAD=ATEND,
            DDNAME='OFFER.DAT'
REPORT DCB LRECL=42, RECFM=F, MACRF=P,
             DDNAME='REPORT.TXT'
*******
      RETURN ADDRESSES
SVSETUP DC F'0'
                             SETUP
           F'0'
SVHDGS DC
                             HDGS
SVPROC
       DC
            F'0'
                             PROCESS
SVREAD DC
           F'0'
                             READ
           F'0'
SVFORM DC
                             FORMAT
SVWRITE DC
SVWRAP DC
            F'0'
                             WRITE
           F'0'
                             WRAPUP
           F'0'
SVCHKLNS DC
                             CHKLNS
***************
       Miscellaneous field definitions
******************
WCRLF DC X'0D25'
EOFSW DC CL1'N'
                       PC/370 ONLY - EBCDIC CR/LF
End of file? (Y/N)
PGS DC PL2'0'
                             Nbr of pages printed.
LNS
       DC
             PL2'10'
                             Lines printed on this page.
MAXLNS DC PL2'10'
                             Max nbr lines per page.
                             My line counts exclude hdgs.
BLANKS DC CL40''
*************************************
       Input record definition
******************
IREC DS OCL18 1-18 Offer record
ISEM DS CL3 1-3 Semester
ICID DS OCL5 4-8 Course ID
IDEPT DS CL2 4-5 Department
DS CL3 6-8 Course number
ISECT DS CL1 9-9 Section number
ITID DS CL3 10-12 Teacher ID
IROOM DS CL4 13-16 Room number
IOCRLF DS CL2 17-18 PC/370 only - CR/LF
****************
      Output (line) definition
*****************
          OCL42 1-42
CL3'' 1- 3
CL3 4- 6
CL4'' 7-10
CL5 11-15
CL6'' 16-21
OREC
      DS
       DC
OSEM
        DS
                             Semester
       DC
OCID
       DS
                             Course ID
       DC
           CL1 22-22 Section number

CL8' 23-30

CL3 31-33 Teacher ID

CL7' 34-40

CL2 41-42 PC/370 only - CR/LF
OSECT
       DS
       DC.
OTID
       DS
       DC
OCRLF
       DS
```

```
Headings definitions
*************
  ----+----3-----4
          COURSE OFFERINGS
                            PageBZZ9
    Sem Course Section Teachers
    XXX XXXXX X
XXX XXXXX X
                         XXX
                           XXX
                          XXX
FORMFEED DS
            0CL42
                            PC/370 only
                            EBCDIC formfeed
            X'0C'
       DC
            CL39' '
       DC
            40C''
       DC
                            For testing...
            X'0D25'
       DC
                            EBCDIC CR/LF
HD1
       DS
            0CL42
       DC
            CL36'
                         COURSE OFFERINGS
                                            Page'
HDPGS
            CL4'BZZ9'
       DC
            XL2'0D25'
       DC
HD2
       DS
            0CL42
            CL40' '
       DC
            XL2'0D25'
       DC
HD3
       DS
            0CL42
            CL40'
       DC
                   Sem Course Section Teacher
            XL2'0D25'
       DC
HD4
       DS
            0CL42
            CL40'
       DC
            XL2'0D25'
       DC.
       END
            BEGIN
```

Single Level Control Break - Programming Problem

Notice that the above report is in semester sequence. Let's modify the report so that there is only one semester per page. Since there will be only one semester per page, it would be redundant to include the semester in the detail lines, so let's drop that column, and show the semester in the headings instead. Also, let's show a count of the number of sections in a semester at the end of each semester. Our new report will appear as follows:

<<< Semester in heading	1	Page	FFERINGS er W92		
		Teacher	Section	Course	
		732 218 574	1 1 1	EG102 MA107 PE151	
<<< Count by semester		cions	3 sect	*** Sem W92	

	OFFERINGS ster F92	Page	2	<<< One semester per page
Course	Section	Teacher		1 - 1 - 3 -
AC101 BU101	1 1	218 218		
EG101 EG101	1 2	732 732		
MA101 MA101	1 2	626 626		
PE151	1	574		
*** Sem F9	2 7 sect	cions		
	OFFERINGS ster W93	Page	3	
Course	Section	Teacher		
EG102 MA101 MA107 PE151	1	854 626 626 574		
*** Sem W9	3 4 sect	cions		

Single Level Control Break - Logic

The changes necessary to produce this report is as follows:

1. <u>Check for a change in semester.</u> In order to see if the semester in one record differs from the semester in the previous record, we will need a variable wherein we can "hold" the semester from record to record. This will be defined as:

```
HOLDSEM DC CL3' ' Hold semester
```

We said the semester would now be a part of the headings:

```
HD2 DS 0CL42
DC CL21' Semester'

HDSEM DS CL3
DC CL16''
DC XL2'0D25'
```

...so prior to printing the headings, we will move Holdsem to HDSEM:

```
HDGS
           EQU
           ST
                  R10, SVHDGS
           ΑP
                  PGS,=P'1'
                                         Add 1 to page count
                  HDPGS, =X'40202120' Edit pattern for page count
HDPGS, PGS Move page count to heading
           MVC
           ED
                                         PC/370 ONLY
           PUT
                  REPORT, FORMFEED
                  HDSEM, HOLDSEM
           MVC
                  REPORT, HD1
           PUT
```

Of course, we want the semester from the first record to be recognized as such, otherwise we will try to print totals after having read the first record only. So, we initialize HOLDSEM within the SETUP routine immediately after the priming read:

```
BAL R10, READ

MVC HOLDSEM, ISEM Control break
```

As each record is processed, we will check for a change in semester. Since this is a check done for each record, it will, of course, fall within the PROCESS routine (as opposed to SETUP OF WRAPUP.) We will invoke a separate routine, CHKSEM, to see if the semester has changed. We do so only to keep the PROCESS routine simple and uncluttered:

```
PROCESS EQU *
ST R10,SVPROC
BAL R10,CHKSEM See if new semester
```

...where CHKSEM is defined as:

```
****************
        CHKSEM - Check for change in semester
                (control break)
CHKSEM
       EOU
        ST
             R10, SVCHKSEM
                               Compare w/ current
             HOLDSEM, ISEM
        CLC
        BE
             CHKSEMX
                               Same semester, get out
        RAT.
             R10.ENDSEM
                               Process semester break
             HOLDSEM, ISEM
        MVC
                               Update control break field
CHKSEMX
       EQU
        L
             R10, SVCHKSEM
        BR
             R10
```

Again, this could have been done within PROCESS as follows:

```
PROCESS
         EQU
                R10, SVPROC
         ST
                HOLDSEM, ISEM
         CLC
                                    Compare w/ current
         BE
                PROCESS2
                                    Same semester, get out
         BAL
               R10, ENDSEM
                                    Process semester break
               HOLDSEM, ISEM
                                    Update control break field
         MVC
PROCESS2 EQU
         (continued)
```

Note that having ended one semester and started another, we move the current semester, ISEM, to the control break field, HOLDSEM.

2. <u>If the semester has changed, then end that semester and start another.</u> We see from CHKSEM that if the semester has changed, that is, if HOLDSEM does not equal ISEM, then we invoke the control break routine, ENDSEM. This new routine will (a) print the number of sections for this semester, (b) reset the sections counter to zero, and (c) force the next semester to a new page:

```
ENDSEM
         ST
               R10, SVENDSEM
               OREC (40), BLANKS
         MVC
                                  This area used several ways
         BAL
               R10,WRITE
                                  Skip a line
               OREC+6(25),=C'*** Sem XXX BZZ9 sections'
         MVC
               OREC+14(3), HOLDSEM
         MVC
         MVC OREC+18(4),=X'40202120'
         ED
               OREC+18(4), #SEM
         BAL
               R10,WRITE
         MVC
               OREC (40), BLANKS
               #SEM,=P'0'
         ZAP
                                  Reset counter
         ZAP
               LNS, MAXLNS
                                  Force next sem. to new page
         т.
               R10, SVENDSEM
         BR
```

Print the number of sections for this semester. Note how the count is formatted. First, the line is cleared. (This is the same area as was used for the details, but we can reuse it for showing the counts if we like.) Of course, when we move BLANKS to OREC, we do so for a length of 40 only so as not to destroy the CR/LF. Otherwise, we would need to remember to move X'0D25' to OREC+40(2). We then move a description of the count. Notice how a long label was used, with XXX indicating where the semester will go, and BZZ9 indicating where the count will go. It is by no means necessary to do it this way. I find this technique to be quite useful in that it is somewhat self-documenting. This is particularly important if we are going to use explicit displacement and length as shown above. Nevertheless, the following is functionally equivalent and probably more commonly used:

```
MVC OREC+6(7),=C'*** Sem'
MVC OREC+14(3),HOLDSEM
MVC OREC+18(4),=X'40202120'
ED OREC+18(4),#SEM
MVC OREC+23(8),=C'sections'
```

Having used the detail line in this way, we must remember to clean up after ourselves; that is, once again move BLANKS to OREC (40).

You might feel uneasy with reusing the detail line as we have done here. It is very common to define a separate record for this purpose:

```
MVC TOTSEM, HOLDSEM
MVC TOTCOUNT, =X'40202120'
ED TOTCOUNT, #SEM
PUT REPORT, TOTREC
AP LNS, =P'1'
```

where...

```
TOTREC
         DS
                0CT42
         DC
                CL6' '
                CL8'*** SEM '
         DC
                CL3' '
TOTSEM
         DC
                CL1' '
         DC
                CL4' '
TOTCOUNT DC
                CL18' sections'
         DC
                           CR/LF
         DC:
                X'0D25'
```

Note that we use PUT REPORT, TOTREC and increment the line counter here rather than BAL R10, WRITE because that (WRITE) routine puts OREC (only) to REPORT.

- 2(b) Reset the sections counter to zero. We move zero to the counter for number of sections within this semester, #SEM. Otherwise, the sections count for semester w92 will be included in the sections count for semester F93, and the sections count for semesters w92 and F93 will be included in the sections count for semester w93.
- 2(c) Force the next semester to a new page. Forcing each new semester to a new page is simple: just set the line counter to the maximum allowed. Recall that before printing any detail lines, we always invoke the CHKLNS routine to see if a page is full and, if so, print the headings. By setting the line counter to the maximum allowed, the page will be considered full and headings will be printed, with the new semester, prior to printing the next detail line
- 3. <u>As each record is processed, add one to the number of sections for that semester.</u> This is done for each record and, as such, is included in the PROCESS routine. It is done after the check for a new semester, otherwise the wrong semester may get "credit" for this record.

```
PROCESS EQU *
ST R10,SVPROC

BAL R10,CHKSEM See if new semester
AP #SEM,=P'1' Count sections by semester
```

4. <u>After all records have been processed, print one last set of totals.</u> Within the WRAPUP routine we invoke the control break routine one last time: not because a new semester has begun, but because the last semester has ended. If we fail to do so, then we will not get a count of sections for the last semester.

```
WRAPUP EQU *
ST R10,SVWRAP

BAL R10,ENDSEM Final control break process
CLOSE OFFER
CLOSE REPORT
```

This can be done before or after closing the OFFER file, but *must* be done *before* closing the REPORT file.

Single Level Control Break - Program Solution

PRINT NOGEN

```
FILENAME: OFFER10B.MLC
        AUTHOR : Bill Qualls
SYSTEM : PC/370 R4.2
REMARKS : Produce list of course offerings for all
                  semesters. Includes page break logic.
              Single level control break example.
        START 0
        REGS
BEGIN
        BEGIN
              'OFFER10B ... Begin execution'
        WTO
             R10, SETUP
        BAL
MAIN
        EQU
        CLI
            EOFSW,C'Y'
        ΒE
             EOJ
             R10, PROCESS
        BAL
        В
             MAIN
EOJ
        EQU
             R10, WRAPUP
        BAL
        WTO 'OFFER10B ... Normal end of program'
        RETURN
       ************
        SETUP - Those things which happen one time only,
            before any records are processed.
SETUP
       EQU *
             R10, SVSETUP
        ST
             OFFER+10,X'08'
                               PC/370 ONLY - Convert all
        ΟI
                               input from ASCII to EBCDIC
             REPORT+10,X'08'
                               PC/370 ONLY - Convert all
        ΟI
                               output from EBCDIC to ASCII
        OPEN OFFER
        OPEN REPORT
        BAL
             R10, READ
        MVC HOLDSEM, ISEM
                               Control break
             R10, SVSETUP
        L
        BR
             R10
  *************
        HDGS - Print headings.
       *******************
        EQU *
HDGS
        ST
             R10,SVHDGS
        ΑP
              PGS,=P'1'
                               Add 1 to page count
            HDPGS,=X'40202120' Edit pattern for page count
        MVC
        ED
             HDPGS,PGS
                               Move page count to heading
        PUT
             REPORT, FORMFEED
                               PC/370 ONLY
        MVC
             HDSEM, HOLDSEM
        PUT
             REPORT, HD1
        PUT
             REPORT, HD2
             REPORT, HD3
        PUT
        PUT
             REPORT, HD4
             REPORT, HD5
        PUT
             LNS, =P'0'
        7.AP
                               Reset line count to zero
             R10, SVHDGS
        L
        BR
```

PROCESS - Those things which happen once per record. * ********** PROCESS EQU * ST R10, SVPROC BAL R10, CHKSEM See if new semester AP #SEM,=P'1' Count sections by semester BAL R10, CHKLNS BAL R10, FORMAT BAL R10, WRITE BAL R10, READ L R10,SVPROC ***************** READ - Read a record. READ EOU * ST R10, SVREAD GET OFFER, IREC Read a single offer record B READX EQU * ATEND MVI EOFSW, C'Y' READX EQU R10, SVREAD Τ. BR ***************** CHKSEM - Check for change in semester (control break) ******************* CHKSEM EQU * ST R10,SVCHKSEM CLC HOLDSEM, ISEM Compare w/ current BE CHKSEMX Same semester, get out
BAL R10,ENDSEM Process semester break
MVC HOLDSEM,ISEM Update control break fi Update control break field CHKSEMX EQU R10,SVCHKSEM R10 L BR ***************** ENDSEM - End semester (Process control break) Show count of sections for this semester. Force next semester to another page. ENDSEM EQU * ST R10,SVENDSEM MVC OREC(40),BLANKS This area used several ways
BAL R10,WRITE Skip a line MVC OREC+6(25),=C'*** Sem XXX BZZ9 sections' MVC OREC+14(3), HOLDSEM
MVC OREC+18(4),=X'40202120' ED OREC+18(4), #SEM BAL R10, WRITE MVC OREC(40), BLANKS ZAP #SEM,=P'0' Reset counter ZAP LNS, MAXLNS Force next sem. to new page L R10,SVENDSEM R10

```
CHKLNS - Check lines printed. Full page?
***********
CHKLNS EQU *
         R10,SVCHKLNS
LNS,MAXLNS
      ST
      CP
      BL CHKLNSX
BAL R10, HDGS
CHKLNSX EOU *
        R10, SVCHKLNS
     L
      BR
          R10
*******************
    FORMAT - Format a single detail line.
**************
        FORMAT EQU *
      ST
      MVC
                       Removed MVC OSEM, ISEM
      MVC
      MVC OSECT, ISECT
      MVC OTID, ITID
MVC OCRLF, WCRLF
                      PC/370 Only
         R10,SVFORM
      L
      BR
          R10
*************
     WRITE - Write a single detail line.
***************
     EQU *
WRITE
      R10, SVWRITE
PUT REPORT, OREC
AP LNS, =P'1'
L R10, SVWRITE
BR R10
                      Write report line
******************
      WRAPUP - Those things which happen one time only, *
            after all records have been processed.
WRAPUP EQU *
         R10, SVWRAP
      BAL R10, ENDSEM Final control break process
      CLOSE OFFER
      CLOSE REPORT
      WTO 'OFFER10B ... Course list on REPORT.TXT'
      L R10, SVWRAP
      BR
         R10
     Literals, if any, will go here
     LTORG
*************
    File definitions
******************
OFFER DCB LRECL=18, RECFM=F, MACRF=G, EODAD=ATEND,
          DDNAME='OFFER.DAT'
REPORT DCB LRECL=42, RECFM=F, MACRF=P,
         DDNAME='REPORT.TXT'
*****************
* RETURN ADDRESSES
*************
SVSETUP DC F'0'
SVHDGS DC F'0'
                       SETUP
                       HDGS
```

SYCHEANS DC F'0' CHKINS SYCHEANS DC F'0' CHKSEM SYCHEANS DC CK 10025' PC/370 ONLY - EBCDIC CR/LF BOFSW DC CL1'N' End of file? (Y/N) PGS DC PL2'10' Nbr of pages printed. DC PL2'10' Lines printed on this page. MAXLNS DC PL2'10' Max nbr lines per page. MAXLNS DC PL2'10' Sections in a semester BLANKS DC CL40' HOLDSEM ** Input record definition *** ** Input record definition *** ** Input record definition *** ** Input record definition ** ** INPUT PROVIDE TO THE TO TH					
SYPERAD DC F'0' FEAD SYPORM DC F'0' FORMAT SYWRITE DC F'0' WRITE SYWRAP DC F'0' WRAPUP SYURKINS DC F'0' CHKINS SYCHKINS DC DC C11'N' End of file? (Y/N) En	CIADDOC	DC	ELOI		DDOCECC
SYPORM DC F'0' FORMAT SYWRATE DC F'0' WRAPUP SYVERIAND DC F'0' WRAPUP SYCHKINS DC F'0' CHKINS SYCHKINS DC CLI'N' ENDOSEM ** Miscellaneous field definitions * ** MISCELLANC DC CLI'N' End of file? (Y/N) EPGS DC FLZ'10' Nor of pages printed. LINS DC PLZ'10' Max nbr lines per page. MaxINS DC PLZ'10' Max nbr lines per page. My line counts exclude hdgs. ELANKS DC CLIO' Hold semester ** Hold semester ** Input record definition *** ** Input record definition ** ** ACCUPATION OF THE PC AND OF THE					
SYMPRAP C					
SWURKAND C F'0' CIKKINS SVCHKINSEM DC F'0' CIKKEM SVENDISEM DC F'0' CIKKEM SVCHKINS DC KI'ODZ5' PC/370 ONLY - EBCDIC CR/LF BOFFW DC CIL'I'N' End of file? (Y/N) PGS DC PL2'10' Nbr of pages printed. LINS DC PL2'10' Max nbr lines per page. My line counts exclude hdgs. BLANKS DC CL40'' HOLDSEM DC CL3'' Hold semester SEEM DC PL2'0' Sections in a semester * Input record definition * Section in a semester * Input record definition * Section in a semester * Input precord definition * Section in a semester * Input precord definition * Section in a semester BIREC DS OCL5 1-3 Semester ICID DS OCL5 1-3 Semester ICID DS OCL5 4-8 Course ID IDEPT DS CL2 4-5 Department DS CL3 6-8 Course number IRECT DS CL1 9-9 Section number IRECT DS CL1 19-9 Section number ICIOCALF DS CL2 17-18 PC/370 only - CR/LF * Output (line) definition * Section number DC CL6'' 16-21 DS CL5 11-15 Course ID DC CL6'' 14-22 DC CL10'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL5 11-15 Course ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL3 31-33 Teacher ID DC CL6'' 34-40 DCCID DS CL5 31-40 DCCID DS CL5					
SYCHEANS DC F'0' CHKIMS SYCHNSEM DC F'0' CHKSEM SYCHOSEM DC CL1'N' End of file? (Y/N) WCRIF DC X'0D25' PC/370 ONLY - EBCDIC CR/LF EOFSW DC CL1'N' End of file? (Y/N) PCS DC PL2'10' Nor of pages printed. LINES printed on this page. MAXINS DC PL2'10' Max nbr lines per page. MAXINS DC CL40' Hold semester BLANKS DC CL40' Sections in a semester ** Input record definition ** ** Output DS CL2 4-8 Course ID DC CL10 9-9 Section number INFORM DS CL4 13-16 Room number INFORM DS CL4 13-16 Room number INFORM DS CL4 13-16 Room number OCRET DS CL1 19-9 Section number ** Output (line) definition ** ** Output (line) de	SVWRITE				WRITE
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** Miscellaneous field definitions ** ** Miscellaneous field definitions ** *** *** *** *** *** ** ** *	SVCHKLNS	3 DC	F'0'		CHKLNS
** Miscellaneous field definitions	SVCHKSEN	1 DC	F'0'		CHKSEM
** Miscellaneous field definitions	SVENDSEN	4 DC	F'0'		ENDSEM
WCRLF DC X'0D25' PC/370 ONLY - EBCDIC CR/LF ECOFSW DC CL1'N' End of file? (Y/N) PCS DC PL2'0' Nor of pages printed. LIMS DC PL2'10' Lines printed on this page. MAXINS DC PL2'10' Max nbr lines per page. * My line counts exclude hdgs. * HOLDSEM DC CL3' Hold semester ** Sections in a semester ** Input record definition * ** Input record definition * ** Sections in a semester ** Input record definition * ** IREC DS OCL18 1-18 Offer record ISEM DS CL3 1-3 Semester ICID DS OCL5 4-8 Course ID IDEPT DS CL2 4-5 Department DS CL3 10-12 Teacher ID INFO DS CL3 10-12 Teacher ID INFO DS CL4 13-16 Room number INFO DS CL2 17-18 PC/370 only - CR/LF ** Output (line) definition * ** OUTPUT (line) definition * ** OU	****	****	****	****	*******
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My line counts exclude hdgs.	-				
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IREC DS OCL18 1-18 Offer record ISEM DS CL3 1-3 Semester ICID DS OCL5 4-8 Course ID IDEPT DS CL2 4-5 Department DS CL3 6-8 Course number ISECT DS CL1 9-9 Section number ITID DS CL3 10-12 Teacher ID IROOM DS CL4 13-16 Room number IOCRLF DS CL2 17-18 PC/370 only - CR/LF ***********************************					
TREC	*				
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ICID	IREC	DS	0CL18	1-18	Offer record
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COURSE OFFERINGS					
**************************************	IROOM	DS	CL4		
* Output (line) definition					PC/370 only - CR/LF
DREC DS OCL42 1-42 DC CL10' 1-10 OCID DS CL5 11-15 Course ID DC CL6' 16-21 OSECT DS CL1 22-22 Section number DC CL8' 23-30 OTID DS CL3 31-33 Teacher ID DC CL7' 34-40 OCRLF DS CL2 41-42 PC/370 only - CR/LF ***********************************	*****				
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DC CL8' ' 23-30 OTID DS CL3 31-33 Teacher ID DC CL7' ' 34-40 OCRLF DS CL2 41-42 PC/370 only - CR/LF ***********************************		DC	CL6' '	16-21	
DTID DS CL3 31-33 Teacher ID DC CL7'' 34-40 DCRLF DS CL2 41-42 PC/370 only - CR/LF ***********************************		DS	CL1	22-22	Section number
DTID DS CL3 31-33 Teacher ID DC CL7'' 34-40 CCRLF DS CL2 41-42 PC/370 only - CR/LF ***********************************	OSECT			23-30	
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**************************************		DS	CL3	31-33	Teacher ID
* Headings definitions	OTID	DS DC	CL3 CL7''	31-33 34-40	
**************************************	OTID OCRLF	DS DC DS	CL3 CL7'' CL2	31-33 34-40 41-42	PC/370 only - CR/LF
*+1+2+3+4 * COURSE OFFERINGS PageBZZ9 * Semester XXX * Course Section Teachers * * XXXXX X XXX * Sem XXX BZZ9 sections	OTID OCRLF	DS DC DS	CL3 CL7'' CL2 ******	31-33 34-40 41-42 *****	PC/370 only - CR/LF
*+1+2+4 * COURSE OFFERINGS PageBZZ9 * Semester XXX * Course Section Teachers *	OTID OCRLF ******	DS DC DS *****	CL3 CL7'' CL2 *******	31-33 34-40 41-42 ********	PC/370 only - CR/LF ************************************
* COURSE OFFERINGS PageBZZ9 * Semester XXX * Course Section Teachers * * XXXXX X XXXX * Sem XXX BZZ9 sections	OTID OCRLF *******	DS DC DS *****	CL3 CL7'' CL2 *******	31-33 34-40 41-42 ********	PC/370 only - CR/LF ************************************
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* Course Section Teachers * * XXXXX X XXXX * XXXXX X XXX	OTID OCRLF ******* * ********	DS DC DS ***** Head *****	CL3 CL7'' CL2 ******* ings def *******	31-33 34-40 41-42 ********** initions ********* -2+	PC/370 only - CR/LF ************ * ********************
* * XXXXX X XXX	OTID OCRLF ******* * * ******* * * *	DS DC DS ***** Head *****	CL3 CL7'' CL2 ******* ings def *******	31-33 34-40 41-42 ********** initions ********* -2+	PC/370 only - CR/LF ************ * ********************
* XXXXX X XXX * XXXXX X XXX * XXXXX X XXX * XXXXX X XXX * XXXX BZZ9 sections	OTID OCRLF ******* * * * * * * *	DS DC DS ***** Head *****	CL3 CL7'' CL2 ******* ings def ******* + COURSE O Semest	31-33 34-40 41-42 ************************************	PC/370 only - CR/LF ***************** * ***************
* XXXXX X XXX * XXXXX X XXX * XXXXX X XXX * * Sem XXX BZZ9 sections	OTID OCRLF ******* * * * * * * * *	DS DC DS ***** Head *****	CL3 CL7'' CL2 ******** ings def ******** COURSE O Semest	31-33 34-40 41-42 ********** initions ********** -2+ FFERINGS er XXX	PC/370 only - CR/LF ****************** ****************
* XXXXX X XXX * * Sem XXX BZZ9 sections	OTID OCRLF ******* * ******* * * * * * *	DS DC DS ****** Head ******	CL3 CL7'' CL2 ******** ings def ******* COURSE O Semest	31-33 34-40 41-42 ********** initions ********** -2+ FFERINGS er XXX Section	PC/370 only - CR/LF ****************** ****************
* Sem XXX BZZ9 sections	OTID OCRLF ******** * ******* * * * * *	DS DC DS ******* Head *******	CL3 CL7'' CL2 ******** ings def ******** 	31-33 34-40 41-42 ********* initions ********* -2+ FFERINGS er XXX Section 	PC/370 only - CR/LF ************ *********** -3+4 PageBZZ9 Teachers XXX
* Sem XXX BZZ9 sections	OTID OCRLF ******** * ******* * * * * *	DS DC DS ******* Head *******	CL3 CL7'' CL2 ******** ings def ******** + COURSE O Semest ourse XXXXX XXXXX	31-33 34-40 41-42 ********** initions ********* -2+ FFERINGS er XXX Section 	PC/370 only - CR/LF *********** ********** -3+4 PageBZZ9 Teachers XXX XXX
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EODMEEED	Da	001.40	DC /	270 1		
FORMFEED		0CL42		370 only		
*	DC	X'0C'	EBC	DIC formfe	eed	
*	DC	CL39' '				
	DC	40C'_'	For	testing	•	
	DC	X'0D25'	EBC	DIC CR/LF		
HD1	DS	0CL42				
	DC	CL36'	COURSE	OFFERINGS	Page '	
HDPGS	DC	CL4'BZZ9'			-	
	DC	XL2'0D25'				
HD2	DS	0CL42				
	DC	CL21'	Semes	ter '		
HDSEM	DS	CL3				
	DC	CL16' '				
	DC	XL2'0D25'				

HD3	DS	0CL42				
	DC	CL40''				
	DC	XL2'0D25'				
HD4	DS	0CL42				
	DC	CL40'	Course	Section	Teacher	T
	DC	XL2'0D25'				
HD5	DS	0CL42				
	DC	CL40'				1
	DC	XL2'0D25'				
	-					
	END	BEGIN				

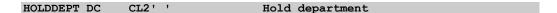
Multiple Level Control Break - Programming Problem

We now introduce *multiple level control break* processing. Let's assume that, in addition to showing a count of sections by semester, we would also like to show a count of sections *by department within semester*; for example, after listing all sections offered by the Math department, we will show a count of those sections. We will, however, show this count only if the count is greater than 1, so as not to clutter our report. Furthermore, we will always double space (skip a line) between departments. Our new report will appear as shown on the next page.

Multiple Level Control Break - Logic

The logic necessary to produce this report is similar to that used in single level control break processing and is as follows:

1. <u>Check for a change in department.</u> Just as we checked for a change in semester in the previous program, we need to check for a change in department in this program. In order to do so, we will need a variable wherein we can "hold" the department from record to record. This will be defined as:



Of course, we want the semester *and* department from the first record to be recognized as such, so we initialize HOLDSEM *and* HOLDDEPT within the SETUP routine after the priming read:

Output from OFFER10C.MLC - Multiple Level Control Break Example

		OFFERINGS ster W92	Page	1	
		Section	Teacher		
	EG102	1	732		
	MA107	1	218		
	PE151	1	574		
	*** Sem W92	3 sect	ions		
		OFFERINGS ster F92	Page	2	
	Course	Section	Teacher		
	AC101	1	218		
	BU101	1	218		
	EG101 EG101	1 2	732 732		
	** Dept EG	2 sect	ions		
	MA101	1	626		
		OFFERINGS ster F92	Page	3	Note that semester F92 "spans" two pages.
	Semes Course			3	
	Semes	ster F92 Section	Teacher	3	
	Course MA101	Section	Teacher 626	3	
_	Course MA101	Section 2 2 sect	Teacher 626	3	
_	Course MA101 ** Dept MA	Section	Teacher 626 ions	3	
	Course MA101 ** Dept MA PE151 *** Sem F92	Section 2 2 sect 1 2 7 sect	Teacher 626 ions		
	Course MA101 ** Dept MA PE151 *** Sem F92 COURSE Semes Course	Section 2 2 sect 1 7 sect OFFERINGS Ster W93 Section	Teacher 626 ions 574 ions Page Teacher		
	Course MA101 ** Dept MA PE151 *** Sem F92 COURSE Semes	Section 2 Section 2 Section 7 Section 2 Section 1 Section 2 Section 2 Section 3 Section 4 Section 4	Teacher 626 cions 574 cions Page		
	Course MA101 ** Dept MA PE151 *** Sem F92 COURSE Semes Course	Section 2 2 sect 1 2 7 sect OFFERINGS Ster W93 Section	Teacher 626 ions 574 ions Page Teacher		
	Course MA101 ** Dept MA PE151 *** Sem F92 COURSE Semes Course EG102 MA101	Section 2 2 sect 1 7 sect OFFERINGS Ster W93 Section 1 1 1	Teacher 626 cions		
	Course MA101 ** Dept MA PE151 *** Sem F92 COURSE Semes Course EG102 MA101 MA107	Section 2 2 sect 1 7 sect OFFERINGS Ster W93 Section 1 1 1	Teacher 626 cions		

```
BAL R10, READ
MVC HOLDSEM, ISEM Major control break
MVC HOLDDEPT, IDEPT Minor control break
```

As each record is processed, we will check for a change in semester *or* department. Since this is a check done for each record, it will fall within the PROCESS routine. We will invoke CHKSEM to see if the semester has changed, and invoke CHKDEPT to see if the department has changed.

It is important to note that a change in semester implies a change in department. For example, if the last department listed in semester w92 was PE, and the first department listed in semester F93 was also PE, then these would appear on two separate pages and have two separate counts. So we check the semester before checking the department:

```
PROCESS
      EQU
           R10, SVPROC
      ST
                          See if new semester
      BAL
           R10, CHKSEM
           R10, CHKDEPT
                          See if new department
      BAL
where CHKSEM and CHKDEPT are...
CHKSEM - Check for change in semester
              (major control break)
*************
CHKSEM EQU *
      ST
           R10, SVCHKSEM
      CLC HOLDSEM, ISEM
                         Compare w/ current
           R10, ENDSEM
      BE
                          Same semester, get out
      BAL
                          Process semester break
      MVC HOLDSEM, ISEM
                          Update major break field
      MVC HOLDDEPT, IDEPT Update minor break field
CHKSEMX
      EQU
           R10, SVCHKSEM
           R10
********************
      CHKDEPT - Check for change in department
              (minor control break)
******************
CHKDEPT EQU
      ST
           R10,SVCHKDEP
      CLC
         HOLDDEPT, IDEPT
                         Compare w/ current
           R10,ENDDEPT
      BE
                        Same department, get out
                          Process department break
      BAL
      MVC
           HOLDDEPT, IDEPT
                          Update control break field
CHKDEPTX EQU
      L
           R10, SVCHKDEP
      BR
           R10
```

In multiple level control break processing, always evaluate the control break fields from major to minor!

2. <u>If the semester has changed, then end that semester and start another.</u> The processing here is the same as in the previous program except *a change in semester implies a change in department*. So the first thing we do within ENDSEM is end the previous department and begin the next department:

```
ENDSEM EQU *
ST R10, SVENDSEM

BAL R10, ENDDEPT Change in semester implies
change in department as well.

MVC OREC (40), BLANKS This area used several ways
MVC OREC+6 (25), =C'*** Sem XXX BZZ9 sections'
```

(ENDDEPT is discussed below.)

In multiple level control break processing, a break at one level implies a break at all lower levels!

3. If the department has changed, then end that department and start another. We see from CHKDEPT that if the department has changed, that is, if HOLDDEPT does not equal IDEPT, then we invoke the control break routine, ENDDEPT. This new routine will (a) print the number of sections for this department (if two or more according to the specifications given above), (b) print a blank line (regardless of the number of sections for this department), and (c) reset the department-level sections counter to zero:

```
ENDDEPT- End department
                  (Process minor control break)
                  Print count of sections in department
                  if that count is two or more.
                  Regardless, skip a line.
ENDDEPT EQU
         ST
               R10, SVENDDEP
         CP
               #DEPT,=P'2'
         BL
               ENDDEPT2
               OREC(40), BLANKS
         MVC
                                  This area used several ways
               R10, WRITE
                                   Blank line before count
         BAL
               OREC+7(24),=C'** Dept XX BZZ9 sections'
         MVC
               OREC+15(2), HOLDDEPT
         MVC
               OREC+18(4),=X'40202120'
         MVC
               OREC+18(4), #DEPT
         BAL
               R10, WRITE
ENDDEPT2 EQU
         MVC
               OREC (40), BLANKS
         BAL
               R10, WRITE
               #DEPT,=P'0'
         ZAP
                                   Reset counter
               R10, SVENDDEP
         L
         BR
               R10
```

If we wanted a count by department, whether or not that count was greater than one, then we need only remove the CP and BL instructions. (This section will not be discussed in detail as the reasoning is similar to that used in the discussion of ENDSEM in the previous program.)

4. <u>As each record is processed, add one to the number of sections for that semester and department.</u> This is done for each record and, as such, is included in the PROCESS routine. It is done after the check for a new semester or new department.

```
PROCESS EQU *
ST R10,SVPROC
BAL R10,CHKSEM See if new semester

BAL R10,CHKDEPT See if new department
AP #SEM,=P'1' Count sections by semester

AP #DEPT,=P'1' Count sections by department
```

5. After all records have been processed, print one last set of totals. Within the WRAPUP routine we invoke ENDSEM one last time, just as in the previous program. Note that we do not need to invoke ENDDEPT, since ENDSEM will do that. Therefore, we will get totals for the last department (if more than 1 section was offered), as well as totals for the last semester. The routine is the same as in the previous program:

```
WRAPUP EQU *
ST R10,SVWRAP
BAL R10,ENDSEM Final control break process
CLOSE OFFER
CLOSE REPORT
```

Multiple Level Control Break - Program Solution

```
PRINT NOGEN
         FILENAME: OFFER10C.MLC
         AUTHOR : Bill Qualls
         SYSTEM : PC/370 R4.2
REMARKS : Produce list of course offerings for all
                    semesters. Includes page break logic.
                    Multiple level control break example.
*******
         START 0
         REGS
BEGIN
         BEGIN
                'OFFER10C ... Begin execution'
         WTO
         BAL
               R10, SETUP
MAIN
         EQU
               EOFSW, C'Y'
         CLI
         ΒE
               EOJ
               R10, PROCESS
         BAL
         В
               MATN
```

```
EOJ
      EOU
           R10, WRAPUP
       BAL
       WTO 'OFFER10C ... Normal end of program'
       RETURN
      ***********
      SETUP - Those things which happen one time only, *
            before any records are processed.
      EQU *
SETUP
       ST
           R10, SVSETUP
       OI
           OFFER+10, X'08'
                           PC/370 ONLY - Convert all
                          input from ASCII to EBCDIC
       OI REPORT+10, X'08'
                          PC/370 ONLY - Convert all
                          output from EBCDIC to ASCII
       OPEN OFFER
       OPEN REPORT
       BAL
           R10, READ
           HOLDSEM, ISEM
                           Major control break
       MVC
       MVC HOLDDEPT, IDEPT Minor control break
           R10, SVSETUP
       L
       BR
           R10
      **********
      HDGS - Print headings.
      HDGS
       EQU
          R10,SVHDGS
       ST
           PGS,=P'1'
       ΑP
                          Add 1 to page count
       MVC
          HDPGS,=X'40202120' Edit pattern for page count
           HDPGS, PGS
                         Move page count to heading PC/370 ONLY
       ED
          REPORT, FORMFEED
       PUT
       MVC
          HDSEM, HOLDSEM
       PUT
           REPORT, HD1
       PUT
           REPORT, HD2
       PUT
          REPORT, HD3
       PUT
           REPORT, HD4
       PUT
           REPORT, HD5
           LNS, =P'0'
                          Reset line count to zero
       ZAP
           R10, SVHDGS
       L
       BR
           R10
*****************
      PROCESS - Those things which happen once per record. *
*****************
PROCESS EQU
           R10, SVPROC
       ST
                           See if new semester
       BAL
           R10, CHKSEM
                        See if new department
       BAL R10, CHKDEPT
           #SEM, =P'1'
#DEPT, =P'1'
       AΡ
                          Count sections by semester
       ΑP
                           Count sections by department
           R10, CHKLNS
       BAL
       BAL
           R10, FORMAT
       BAL
           R10, WRITE
       BAT.
           R10, READ
       L
           R10, SVPROC
       BR
           R10
      ************
      READ - Read a record.
EQU *
READ
           R10, SVREAD
       ST
       GET
           OFFER, IREC Read a single offer record
           READX
       В
```

```
ATEND
       EOU
            EOFSW, C'Y'
       MVI
     EQU
READX
           R10, SVREAD
       L
       BR
            R10
*****************
       CHKSEM - Check for change in semester
              (major control break)
******************
CHKSEM EQU *
       ST
            R10, SVCHKSEM
       CLC HOLDSEM, ISEM
                          Compare w/ current
            CHASEMX Same semester, get out R10, ENDSEM
          CHKSEMX
       BE
       BAL
       MVC HOLDSEM, ISEM Update major break field
       MVC HOLDDEPT, IDEPT Update minor break field
CHKSEMX
       EOU
           R10, SVCHKSEM
     ****************
       CHKDEPT - Check for change in department
               (minor control break)
*******************
CHKDEPT EQU *
       ST
            R10,SVCHKDEP
       CLC HOLDDEPT, IDEPT
                          Compare w/ current
       BE CHKDEPTX Same department, get out
BAL R10,ENDDEPT Process department break
MVC HOLDDEPT,IDEPT Update control break fiel
           HOLDDEPT, IDEPT
                           Update control break field
CHKDEPTX EQU
       L
           R10,SVCHKDEP
       BR R10
*****************
       ENDSEM - End semester
              (Process major control break)
               Show count of sections for this semester.
               Force next semester to another page.
ENDSEM EQU *
           R10, SVENDSEM
       BAL R10, ENDDEPT
                        Change in semester implies
                          change in department as well.
       MVC OREC(40), BLANKS This area used several ways
       MVC OREC+6(25),=C'*** Sem XXX BZZ9 sections'
       MVC
           OREC+14(3), HOLDSEM
       MVC
          OREC+18(4),=X'40202120'
       ED
           OREC+18(4), #SEM
            R10,WRITE
       BAL
       MVC
           OREC (40), BLANKS
           #SEM, =P'0'
       ZAP
                           Reset counter
       ZAP
            LNS, MAXLNS
                            Force next sem. to new page
            R10, SVENDSEM
       L
       RR
            R10
*******************
       ENDDEPT- End department
               (Process minor control break)
              Print count of sections in department
              if that count is two or more.
              Regardless, skip a line.
*******************
```

```
ENDDEPT EQU
           R10, SVENDDEP
       ST
           #DEPT,=P'2'
       CP
      ВL
           ENDDEPT2
      MVC OREC (40), BLANKS
                         This area used several ways
         R10, WRITE
       BAL
                         Blank line before count
           OREC+7(24),=C'** Dept XX BZZ9 sections'
      MVC
      MVC OREC+15(2), HOLDDEPT
      MVC OREC+18(4),=X'40202120'
           OREC+18(4), #DEPT
       ED
      BAL
           R10,WRITE
ENDDEPT2 EQU
      MVC OREC(40), BLANKS
       BAL
           R10,WRITE
      ZAP
           #DEPT,=P'0'
                         Reset counter
          R10, SVENDDEP
      L
      BR
          R10
*****************
      CHKLNS - Check lines printed. Full page?
**************
CHKLNS EQU *
          R10, SVCHKLNS
      ST
      CP
          LNS, MAXLNS
       _{\mathrm{BL}}
           CHKLNSX
       BAL R10, HDGS
CHKLNSX EQU *
         R10, SVCHKLNS
R10
      L
      BR
*************
     FORMAT - Format a single detail line.
*****************
FORMAT EQU *
       ST
           R10,SVFORM
          OREC (40), BLANKS
      MVC
      MVC OCID, ICID
MVC OSECT, ISECT
MVC OTID, ITID
                         Course ID
                         Section number
                         Teacher ID
      MVC OCRLF, WCRLF
                         PC/370 Only
         R10,SVFORM
R10
       L
      BR
*****************
      WRITE - Write a single detail line.
****************
      EQU *
WRITE
       ST
           R10, SVWRITE
       PUT
          REPORT, OREC
                        Write report line
          LNS,=P'1'
      AΡ
           R10, SVWRITE
       L
         R10
      BR
********************
      WRAPUP - Those things which happen one time only,
             after all records have been processed.
**********
WRAPUP EQU *
           R10,SVWRAP
       ST
          R10, ENDSEM
                        Final control break process
      BAL
       CLOSE OFFER
       CLOSE REPORT
       WTO 'OFFER10C ... Course list on REPORT.TXT'
```

	L	R10, SVWRAP	
als als als als als als als als als	BR	R10	******

******		als, if any, wil	*************************************
	LTORG		
*****		*****	******
*	File o	definitions	*
*****	****	******	*******
OFFER	DCB	LRECL=18, RECFM=	F, MACRF=G, EODAD=ATEND,
		DDNAME='OFFER.D	
REPORT	DCB	LRECL=42, RECFM=	•
		DDNAME='REPORT.	
******			*************************
		N ADDRESSES	*******
SVSETUP	DC	F'0'	SETUP
SVHDGS	DC	F'0'	HDGS
SVPROC	DC	F'0'	PROCESS
SVREAD	DC	F'0'	READ
SVFORM	DC	F'0'	FORMAT
SVWRITE		F'0'	WRITE
SVWRAP	DC	F'0'	WRAPUP
SVCHKLNS	DC	F'0'	CHKLNS
SVCHKSEM		F'0'	CHKSEM
SVCHKDEP	DC	F'0'	CHKDEPT
SVENDSEM		F'0'	ENDSEM
SVENDDEP		F'0'	ENDDEPT ************************************
*		llaneous field d	
*****			***********************************
	*****	*****	********
******** WCRLF EOFSW			**************************************
WCRLF	****** DC	************** X'0D25'	********
WCRLF EOFSW	****** DC DC	*************** X'0D25' CL1'N'	**************************************
WCRLF EOFSW PGS	****** DC DC DC	**************************************	**************************************
WCRLF EOFSW PGS LNS	****** DC DC DC DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10'	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS	DC DC DC DC DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40''	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs.
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM	DC DC DC DC DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3''	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM	DC DC DC DC DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3''	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM	DC DC DC DC DC DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40' CL3' CL2' PL2'0'	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT	DC D	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0'	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester/dept
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT	DC D	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' CL2'' PL2'0' PL2'0'	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ********	****** DC	X'************* X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40' CL3' PL2'0' PL2'0' PL2'0' ***********************************	********* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ********	****** DC	X'************* X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40' CL3' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************************************	****** DC DC DC DC DC DC DC DC DC TC DC DC TC DC TC DC TC	X'************* X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************************************	****** DC DC DC DC DC DC DC DC DC TC DC DC TC DC TC DC TC	X'************* X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' ***********************************	******************** PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ***********************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************************************	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' CL2'' PL2'0' PL2'0' ***********************************	********************* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ***********************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************************************	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' PL2'0' A***********************************	******************** PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ***********************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT ************************************	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' PL2'0' PL2'0' Arrend definiti Arrend definition Arrend defini	********************* PC/370 ONLY - EBCDIC CR/LF End of file? (Y/N) Nbr of pages printed. Lines printed on this page. Max nbr lines per page. My line counts exclude hdgs. Hold semester Hold department Sections in a semester Sections in a semester/dept ***********************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ********* IREC ISEM ICID IDEPT ISECT ITID	DC D	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL3'' CL2'' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ********* IREC ISEM ICID IDEPT ISECT ITID IROOM	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' CL2'' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************ IREC ISEM ICID IDEPT ISECT ITID IROOM IOCRLF	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' **********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT #SEM #DEPT ************ IREC ISEM ICID IDEPT ISECT ITID IROOM IOCRLF	****** DC	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT ************************************	****** DC DC DC DC DC DC DC DC ****** DS DS DS DS DS DS DS DS DS OS DS DS OS DS DS OS DS O	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT *SEM **********************************	****** DC DC DC DC DC DC DC DC DC ****** DS OS DS	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT ************************************	****** DC DC DC DC DC DC DC DC ****** DS DS DS DS DS DS DS DS DS OS DS DS OS DS DS OS DS O	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' PL2'0' ***********************************	**************************************
WCRLF EOFSW PGS LNS MAXLNS * BLANKS HOLDSEM HOLDDEPT *SEM **********************************	****** DC DC DC DC DC DC DC DC ****** DS	X'0D25' CL1'N' PL2'0' PL2'10' PL2'10' CL40'' CL3'' PL2'0' PL2'0' PL2'0' ***********************************	**************************************

```
CL6' '
        DC.
                        16 - 21
OSECT
        DS
                        22-22
                                 Section number
              CL1
              CL8' '
                        23-30
        DC
              CL3
OTTD
        DS
                        31 - 33
                                 Teacher ID
        DC
              CL7'
                        34 - 40
OCRLF
        DS
              CL2
                        41-42
                                 PC/370 only - CR/LF
        ****************
        Headings definitions
   ----+----3-----4
            COURSE OFFERINGS
                                 PageBZZ9
              Semester XXX
           Course Section
                             Teachers
            XXXXX
                                XXX
            XXXXX
                       X
                                XXX
            XXXXX
                       Χ
                                XXX
            Dept XX BZZ9 sections
            Sem XXX BZZ9 sections
                                 PC/370 only
              0CL42
FORMFEED DS
        DC
              X'0C'
                                 EBCDIC formfeed
              CL39' '
        DC
              40C''
                                 For testing...
        DC
              X'0D25'
        DC.
                                 EBCDIC CR/LF
HD1
              0CL42
        DC
              CL36'
                             COURSE OFFERINGS
                                                   Page'
HDPGS
              CL4'BZZ9'
        DC
        DC
              XL2'0D25'
HD2
        DS
              0CL42
        DC
                               Semester '
              CL21'
HDSEM
        DS
              CL3
        DC
              CL16' '
              XL2'0D25'
        DC
HD3
        DS
              0CL42
              CL40'
        DC
              XL2'0D25'
        DC
        DS
              0CL42
HD4
        DC.
              CT.40 '
                            Course Section Teacher
        DC
              XL2'0D25'
HD5
        DS
              0CL42
        DC
              CL40'
              XL2'0D25'
        DC
        END
              BEGIN
```

Rolling Totals

There is more than one way to keep the count of sections by department *and* by semester. In our solution we added one to each of these two counters in the PROCESS routine. It is also common to increment the minor counter only (the minor counter is, in this case, the count of sections by department, #DEPT). Then, when a minor control break is detected, add the minor count to the major count, before resetting the minor count to zero. This is sometimes referred to as "rolling" the totals. The implementation of this "rolling" logic would be as follows:

```
PROCESS EQU
                  ST
                        R10, SVPROC
                 BAL
                        R10, CHKSEM
                        R10, CHKDEPT
                 BAL
                                               Have removed AP #SEM, =P'1'
                 ΑP
                        #DEPT, =P'1'
and...
       ENDDEPT
                 EQU
                  BAL
                        R10, WRITE
                                              Roll counts
                        #SEM, #DEPT
                  AΡ
                        #DEPT,=P'0'
R10,SVENDDEP
                  ZAP
                                              Reset counter
                  BR
                        R10
```

This technique is actually more efficient than the previous method. There are a total of two APS, so the program size is this same. But in the old method, #SEM is incremented (by one) once for each record. In this method, #SEM is incremented (by the amount in #DEPT) once for each department. The technique to be used is a matter of personal preference, but you should certainly be able to recognize and understand both.

Summary Report - Programming Problem

In our final version of the program we wish to produce a *summary* report only; that is, rather than list each course and section offered during a given semester, we will show each department and the number of sections offered by that department. Our new report will appear as follows:

	OFFERINGS ter W92	Page	1
Dept	Sections		
EG MA PE	1 1 1		
Total	3		
	OFFERINGS ter F92	Page	2
Dept	Sections		
AC BU EG MA PE	1 1 2 2 1		
Total	7		

	OFFERINGS ster W93	Page	3
Dept	Sections		
EG	1		
MA	2		
PE	1		
Total	4		

Summary Report - Logic

Though this report differs considerably from the previous report, the changes necessary to produce this report are really quite trivial. First, there is no record level reporting, so the branch-and-link to the format and write routines have been removed from the process routine. In fact, the format routine has been removed from the program entirely. Second, the format of the counts has been changed in the ENDSEM and ENDDEPT routines. All other changes are for formatting purposes only.

Summary Report - Program Solution

```
PRINT NOGEN
              FILENAME: OFFER10D.MLC
              AUTHOR : Bill Qualls
SYSTEM : PC/370 R4.2
              REMARKS: Produce list of course offerings for all
                        semesters. Includes page break logic.
                        Multiple level control break.
                      Minor break (dept) is summary only.
              START 0
              REGS
      BEGIN
              BEGIN
                    'OFFER10D ... Begin execution'
              WTO
                   R10, SETUP
              BAL
      MAIN
              EQU
              {\tt CLI}
                   EOFSW, C'Y'
              BE
                   EOJ
              BAL
                   R10, PROCESS
                   MAIN
              EOU
      EOJ
                   R10, WRAPUP
              BAL
              WTO
                   'OFFER10D ... Normal end of program'
              RETURN
             ***************
              SETUP - Those things which happen one time only,
                     before any records are processed.
      ******************
      SETUP
              EQU *
              ST
                   R10, SVSETUP
              OI
                 OFFER+10,X'08'
                                   PC/370 ONLY - Convert all
                                     input from ASCII to EBCDIC
(continued)
```

```
REPORT+10,X'08' PC/370 ONLY - Convert all
                           output from EBCDIC to ASCII
       OPEN OFFER
       OPEN REPORT
       BAL R10, READ
MVC HOLDSEM, ISEM
                          Major control break
       MVC HOLDDEPT, IDEPT
                          Minor control break
       L
            R10, SVSETUP
          R10
       BR
      ***********
      HDGS - Print headings.
      EQU *
HDGS
       ST
           R10, SVHDGS
          PGS,=P'1'
       AΡ
                           Add 1 to page count
       MVC HDPGS,=X'40202120' Edit pattern for page count
                         Move page count to heading PC/370 ONLY
       ED
           HDPGS, PGS
       PUT REPORT, FORMFEED
       MVC HDSEM, HOLDSEM
       PUT
           REPORT, HD1
          REPORT, HD2
       PUT
           REPORT, HD3
       PUT
       PUT
           REPORT, HD4
       PUT REPORT, HD5
       ZAP LNS, =P'0'
                           Reset line count to zero
            R10, SVHDGS
          R10
       BR
*****************
      PROCESS - Those things which happen once per record. *
PROCESS EQU *
       ST
           R10,SVPROC
       BAL R10, CHKSEM
                          See if new semester
                         See if new department
       BAL R10, CHKDEPT
       AΡ
           #SEM,=P'1'
                           Count be semester
          #DEPT,=P'1'
                          Count by semester/dept
       AΡ
       BAL R10, READ
                           No detail-level reporting
           R10, SVPROC
                            Removed BAL to FORMAT and WRITE
       L
          R10
       BR
************
      READ - Read a record.
READ
     EQU *
          R10, SVREAD
OFFER, IREC
       ST
       GET
                         Read a single offer record
           READX
      В
ATEND
      EQU
          EOFSW, C'Y'
      MVT
READX
      EQU *
           R10, SVREAD
       L
          R10
      BR
*************
      CHKSEM - Check for change in semester
              (major control break)
CHKSEM EQU *
ST R10, SVCHKSEM
       CLC HOLDSEM, ISEM Compare w/ current

RE CHKSEMX Same semester, get
       BE
           CHKSEMX
                           Same semester, get out
       BAL R10, ENDSEM
                           Process semester break
```

```
HOLDSEM, ISEM Update major break field HOLDDEPT, IDEPT Update minor break field
           HOLDSEM, ISEM
       MVC
       MVC
CHKSEMX EOU
           R10, SVCHKSEM
       L
       BR
            R10
   *************
       CHKDEPT - Check for change in department
              (minor control break)
CHKDEPT EQU *
       ST
            R10, SVCHKDEP
       CLC HOLDDEPT, IDEPT
                          Compare w/ current
       BE CHKDEPTX Same department, get out
BAL R10,ENDDEPT Process department break
MVC HOLDDEPT,IDEPT Update control break field
CHKDEPTX EQU
       L
            R10, SVCHKDEP
       BR
            R10
ENDSEM - End semester
              (Process major control break)
               Show count of sections for this semester.
               Force next semester to another page.
ENDSEM EQU *
       ST
            R10, SVENDSEM
       BAL R10, ENDDEPT
                          Change in semester implies
                            change in department as well.
       PUT REPORT, HD5
       AP
           LNS, =P'1'
            OREC(40), BLANKS
       MVC
                           Reuse this line
       MVC ODEPT(5),=CL5'Total'
       MVC O#DEPT, =X'40202120'
       ED O#DEPT, #SEM
       BAL R10, WRITE
            OREC(40), BLANKS
       MVC
       ZAP #SEM,=P'0'
                          Reset semester record count
       ZAP
            LNS, MAXLNS
                           Force next sem. to new page
       L
            R10, SVENDSEM
  *****************
       ENDDEPT- End department
              (Process minor control break)
               Print a count of courses (sections) in
              this department.
*****************
ENDDEPT EQU *
       ST
            R10, SVENDDEP
           R10, CHKLNS
       MVC
            OREC(40), BLANKS
       MVC ODEPT, HOLDDEPT
                            Department
       MVC O#DEPT, =X'40202120'
            O#DEPT, #DEPT How many this department?
       ED
       MVC OCRLF, WCRLF
                         PC/370 only
       BAL R10, WRITE
       ZAP #DEPT,=P'0'
                            Reset dept record count
          R10, SVENDDEP
       L
       BR
************
      CHKLNS - Check lines printed. Full page?
```

```
EQU
CHKLNS
      ST
           R10, SVCHKLNS
      CР
          LNS, MAXLNS
          CHKLNSX
      BT.
      BAL
          R10, HDGS
CHKLNSX EQU
         R10, SVCHKLNS
R10
      L
      BR
**********
     WRITE - Write a single detail line.
***********
      EQU *
WRITE
      ST R10, SVWRITE
PUT REPORT, OREC
      ST
                        Write report line
          LNS,=P'1'
      AP LNS, =P'1'
L R10, SVWRITE
      BR
           R10
*****************
      WRAPUP - Those things which happen one time only,
             after all records have been processed.
******************
WRAPUP EQU *
      ST
          R10, SVWRAP
      BAL R10, ENDSEM
                        Final control break process
      CLOSE OFFER
      CLOSE REPORT
      WTO 'OFFER10D ... Course list on REPORT.TXT'
      L R10, SVWRAP
      BR
          R10
      ****************
      Literals, if any, will go here
    **********
      LTORG
   *****************
      File definitions
                  ********
OFFER DCB LRECL=18, RECFM=F, MACRF=G, EODAD=ATEND,
           DDNAME='OFFER.DAT'
REPORT DCB LRECL=42, RECFM=F, MACRF=P,
          DDNAME='REPORT.TXT'
*****************
      RETURN ADDRESSES
***********
SVSETUP DC F'0'
                         SETUP
          F'0'
SVHDGS DC
                         HDGS
          F'0'
SVPROC DC
                         PROCESS
SVREAD
      DC
           F'0'
                         READ
SVFORM DC
          F'0'
                         FORMAT
          F'0'
SVWRITE DC
                         WRITE
SVWRAP
      DC
           F'0'
                         WRAPUP
SVCHKLNS DC
          F'0'
                         CHKLNS
          F'0'
SVCHKSEM DC
                         CHKSEM
SVCHKDEP DC
           F'0'
                         CHKDEPT
          F'0'
SVENDSEM DC
                         ENDSEM
         F'0'
SVENDDEP DC
                         ENDDEPT
     Miscellaneous field definitions
WCRLF DC X'0D25'
EOFSW DC CL1'N'
                         PC/370 ONLY - EBCDIC CR/LF
End of file? (Y/N)
      DC
         CL1'N'
     DC PL2'0'
PGS
                         Nbr of pages printed.
```

```
PL2'10'
      DC.
LNS
                           Lines printed on this page.
MAXLNS
      DC
           PL2'10'
                           Max nbr lines per page.
                           My line counts exclude hdgs.
          CL40' '
BLANKS DC
HOLDSEM DC
           CL3' '
                           Hold semester
           CL2' '
HOLDDEPT DC
                          Hold department
    DC
           PL2'0'
#SEM
                           Sections in a semester
#DEPT
       DC
           PL2'0'
                           Sections in a semester/dept
*****************
* Input record definition
*******************
IREC DS OCL18
                    1-18
                         Offer record
ISEM DS CL3
ICID DS OCL5
IDEPT DS CL2
                  1-3 Semester
4-8 Course ID
4-5 Department
      DS CL3
                   6-8 Course number
9-9 Section number
               9-9 Sec...

10-12 Teacher ID

13-16 Room number

17-18 PC/370 only - CR/LF
ISECT
       DS
           CL1
      DS CL3
ITID
      DS CL4
IROOM
IOCRLF
***************
DS 0CL42 1-42 1-10
OREC
           CL10' '
            CL2
ODEPT
       DS
                    11-12
                           Department
                  13-19
       DC
           CL7''
O#DEPT
      DS
           CL4
                20-23 Number of sections
          CL17' '
                  24-40
       DC
OCRLF DS CL2 41-42 PC/370 only - CR/LF
      Headings definitions
***********
  ----+---3-----4
          COURSE OFFERINGS PageBZZ9
            Semester XXX
                Sections
          Dept
          XX
                BZZ9
                 BZZ9
          XX
          Total BZZ9
FORMFEED DS
            0CL42
                           PC/370 only
           X'0C'
                           EBCDIC formfeed
       DC
           CL39' '
       DC
       DC
                           For testing...
           X'0D25'
                           EBCDIC CR/LF
       DC.
HD1
       DS
           0CL42
                       COURSE OFFERINGS Page'
       DC
           CL36'
           CL4'BZZ9'
HDPGS
       DC
           XL2'0D25'
       DC
HD2
       DS
           0CL42
       DC
                         Semester '
           CL21'
HDSEM
       DS
           CL3
           CL16' '
       DC
           XL2'0D25'
       DC
```

HD3	DS	0CL42			
	DC	CL40' '			
	DC	XL2'0D25'			
HD4	DS	0CL42			
	DC	CL40'	Dept	Sections	1
	DC	XL2'0D25'			
HD5	DS	0CL42			
	DC	CL40'			,
	DC	XL2'0D25'			
	END	BEGIN			

Exercises

1. True or false.

- T F a. In control break processing, the control break field(s) are initialized in SETUP prior to the priming read.
- T F b. When multiple level control breaks are used, the control break fields are evaluated minor before major.
- T F c. When multiple level control breaks are used, a major break implies a minor break
- T F d. Rather than increment counters at all levels within PROCESS, the major totals can be "rolled" into the minor totals.
- T F e. When a control break is detected, counters or totals are rolled before they are zeroed.
- T F f. Multiple level control break processing requires two hold fields for each level.
- T F g. A simple technique for forcing a page break in control break processing is to set the page counter to the maximum allowed.
- T F h. Adding control break logic to a program will necessitate a change to the mainline.
- T F i. Adding control break logic to a program will necessitate a change to the WRAPUP routine.
- T F j. Adding control break logic to a program will necessitate a change to the report DCB.
- T F k. Changes in the control break fields are checked prior to formatting the report detail line for the current record.
- T F l. Control break logic can be used in summary reports as well as in detail reports.
- T F m. A separate line counter is needed for each level of control break processing.
- 2. (Refer to the Small Town Hardware Store database in <u>More Datasets</u>.) Produce a list of the tools found in each kit. Allow 10 lines per page. Your output should appear as follows:

1	2	3	4
1234567890123456	5789012345	67890123456	57890
SMALL TOWN	HARDWARE	Page	BZZ9
Kit. ID	Tool ID		
XXX	XXX		
212121	XXX		
	AAA		
XXX	XXX		
	XXX		
	XXX		

Exercises

The kit ID should be printed on the first line for that kit, and on the first line for a page if that kit's listing should span a page break. Double space between kits.

3. (Refer to the Small Town Blood Bank database in <u>More Datasets</u>.) Use the donation file to produce a group history summary as follows:

1 1234567890	12345	2 5678901	3 1234567890
SMALL	TOWN	BLOOD	BANK
Group	ID	Numbe Donat	er of
XXX		BZ	49
XXX		BZ	Z 9
XXX		BZZ	Z 9
Total		B7.5	7, 9

In order to produce this report, the file will need to be sorted by group ID. DOS' SORT command is crude but will suffice. Type the following at the DOS prompt:

```
sort /+4 < donation.dat > donation.srt
```

This will create a new file, DONATION. SRT, which is sorted beginning with the fourth column of each record. Specify DONATION. SRT as the DDNAME for the input DCB.

4. (Refer to the Small Town Blood Bank database in <u>More Datasets</u>.) Produce a donor history summary as follows:

	1	2	3	4	5
123456789	01234	1567890123	45678901	2345678901	234567890
		SMALL TOW	N BLOOD	BANK	Page BZZ9
Dono	or ID	First Donatio			nber of nations
XX XX XX	XΧ	mm/dd/y mm/dd/y mm/dd/y	y mm/d	ld/yy E	3ZZ9 3ZZ9 3ZZ9

In order to produce this report, the file will need to be sorted by donor ID. DOS' SORT command is crude but will suffice. Type the following at the DOS prompt:

```
sort /+1 < donation.dat > donation.srt
```

This will create a new file, DONATION.SRT, which is sorted beginning with the first column of each record. Specify DONATION.SRT as the DDNAME for the input DCB.

Exercises

(Hint: reformat the dates from mmddyy to yymmdd. The minimum date for a particular donor will be the first donation date, and the maximum date will be the last donation date.)

5. (Refer to the Small Town Payroll database in <u>More Datasets</u>.) Use the HISTORY file to produce a payroll register for all pay periods. The report should appear as follows, with *one pay period per page*:

1	4	2	3	4	5
123456789012	34567890	012345	67890123	456789012345	67890
	SMALL TO	AA NWC	YROLL		

Payroll Register for PPED mm/dd/yy

Employee	Hours	Gross
XXX	BZZ9.99	BZZ,ZZ9.99
XXX	BZZ9.99	BZZ,ZZ9.99
XXX	BZZ9.99	BZZ,ZZ9.99
TOTAL	BZZ9.99	BZZ,ZZ9.99

There were BZZ9 checks printed for PPED mm/dd/yy.