Common Business Oriented Language

Presented by Cristopher Bohol

HISTORY OF COBOL

- COBOL was first designed in 1959 by CODASYL.
- In late 1962, IBM announced that COBOL is going to be their primary development language.
- COBOL edition 1965 introduces the facilities for handling mass storage files and tables
- In 1968, COBOL was recognized and approved by ANSI standard language for standard commercial use.
- By 1970, COBOL had become the widely used programming language in the world.
- In 1982, ISO installed then-SC5's first Working Group: WG4 COBOL
- In 1985, the ISO working group 4 was accepted this version of the ANSI proposed standard.
- In 2002, the first Object-Oriented COBOL was released, which could be encapsulated as part of COBOL.
- In 2012, Computerworld surveys found out that over 60% of organizations still using COBOL.
- COBOL 2014 includes features like Method overloading, Dynamic capacity tables, etc.

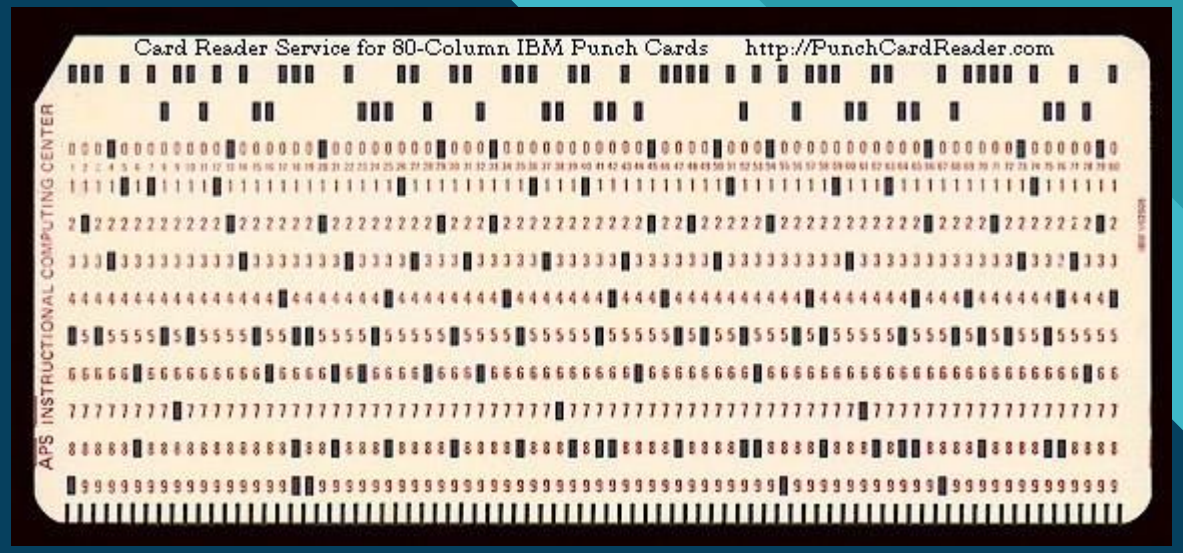
COBOL HARDWARE

COBOL Coding · Create Sales Report Module

The COBOL coding for the Create Sales Report module is illustrated in Figure 9-24.

EXAMPLE

```
A000-CREATE-SALES-REPORT.
    OPEN INPUT  SALES-INPUT-FILE
         OUTPUT SALES-REPORT-FILE.
    READ SALES-INPUT-FILE
         AT END
            MOVE 'NO ' TO ARE-THERE-MORE-RECORDS.
    IF THERE-IS-A-RECORD
       MOVE CUSTOMER-NO-INPUT TO PREVIOUS-CUSTOMER-NUMBER
       MOVE SALESMAN-NO-INPUT TO PREVIOUS-SALESMAN-NUMBER
       MOVE BRANCH-NO-INPUT TO PREVIOUS-BRANCH-NUMBER
       PERFORM A001-PROCESS-AND-READ
            UNTIL THERE-ARE-NO-MORE-RECORDS
       PERFORM B010-PROCESS-CUSTOMER-CHANGE
       PERFORM B020-PROCESS-SALESMAN-CHANGE
       PERFORM B030-PROCESS-BRANCH-CHANGE
       PERFORM B040-PRINT-FINAL-TOTAL.
    CLOSE SALES-INPUT-FILE
          SALES-REPORT-FILE.
    STOP RUN.
```



Why Cobol?

- Billions of lines of existing code with more added each year
- Designed for business
- Great Compilers
- Runs fast
- Relatively simple to learn
- The Language keeps evolving

Program Organization

- Program – Organized like a book
- Division – Identification, Environment, Data, Procedure
- Section - Logical Subdivision of Program Logic
- Paragraph – Subdivision of section or division. It is either a user-defined or a predefined name followed by a period and consist of zero or more sentences/entries.
- Sentence – Combination of one or more statements. Sentences appear only in Procedure Division. A sentence must end with a period.
- Clause - Used to Specify how a data item is to be stored in the computer’s memory
- Phrase – Specifies the parameters that a program is called or the method is invoked.
- Word – a character-string that forms a user-defined word, a system-name or a reserved word.

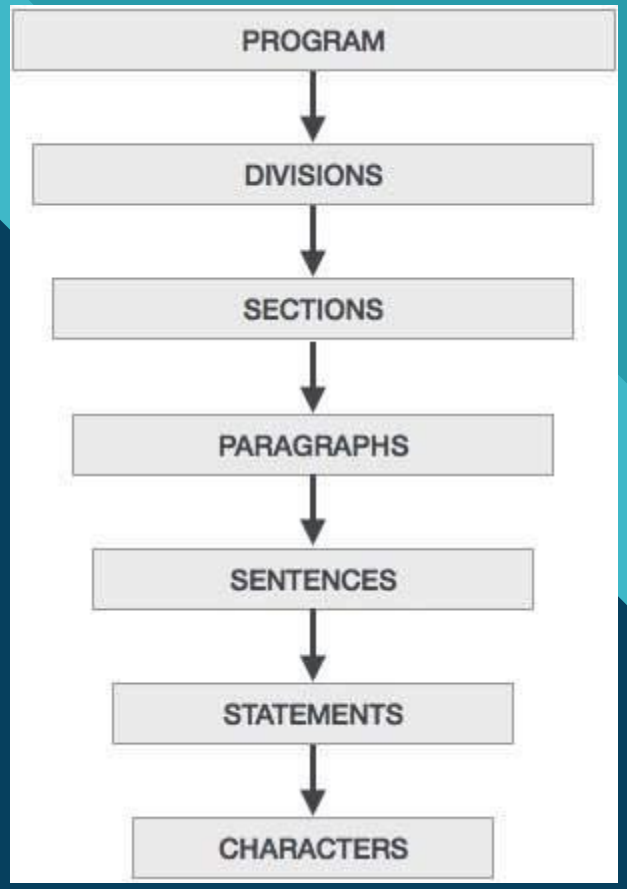
Grammatical Hierarchy

- The grammatical hierarchy follows this form:
- Identification division
  - Paragraphs
    - Entries
      - Clauses
- Environment division
  - Sections
    - Paragraphs
      - Entries
        - Clauses
        - Phrases
- Data division
  - Sections
    - Entries
      - Clauses
        - Phrases
- Procedure division
  - Sections
    - Paragraphs
      - Sentences
        - Statements
        - Phrases

0-format.cbl

Structure of a Program

```
*****************************************************************
* Author: Cristopher Bohol
* Date: March 29, 2022
* Purpose: Programming Languages Report
* Tectonics: cobc
*****************************************************************
*AREA A
*    AREA B
 IDENTIFICATION DIVISION.
*Paragraph
*    Entries
*        Clauses
 PROGRAM-ID. PL-REPORT.
 ENVIRONMENT DIVISION.
*Sections
*    Paragraph
*        Entries
*            Clauses
*            Phrases
 DATA DIVISION.
*Sections
*    Entries
*        Clauses
*            Phrases
 FILE SECTION.
 WORKING-STORAGE SECTION.
 PROCEDURE DIVISION.
 MAIN-PROCEDURE.
*Sections
*    Paragraphs
*        Sentences
*            Statements
*            Phrases
 END PROGRAM PL-REPORT.
```



Coding Rules

```
001432              10  REC-COUNT                PIC 9(05)    VALUE ZERO.
=COLS> 1 2 3 4 5 6|7| 8 9 10
       ----+----1----+----2----+----3----+----4----+----5----+----6----+----7--
001433              10  EOF-FLAG                PIC X(3)    VALUE SPACES.
001434          PROCEDURE DIVISION.
001435
001436          010-START-HERE.
001437              OPEN INPUT INPUT-FILE
```

- Cols 1-6 – left blank. Compiler fills in with sequence numbers
- Col 7 – Usually blank,* means comment line, - is continuation, D for debugging lines
- Cols 8-11 – “A” margin or Area A
- Cols 12-72 – “B” margin or Area B
- Cols 73-80 – unused
- 1 2 3 4 5 6|7| 8 9 10 11|12 13 …71 71 |

  Seq Nos | | Area A | Area B |

Continuation of Statements

1 2 3 4 5 6|7| 89 10

```
=COLS> ----+----1----+----2----+----3----+----4----+----5----+--
007100            MOVE 0 TO I
007200            READ INPUT-FILE
007300              AT END
007400                MOVE "YES" TO EOF-FLAG
007500            END-READ
```

- Statements can be continued on the next line in Area B

Continuation of Literals

```
=COLS> ----+----1----+----2----+----3----+----4----+----5----+----6----+----7--
006500            10  TEMP-OUT                PIC ZZ9.
006510        01  BIGVAR                   PIC X(50) VALUE '12345678901234567 8
006520       -    '901234567890'.
006550        01  BIGVAR1                  PIC X(120) VALUE
006551                   "AAABBBBBBBBBBCCCCCCCCCCDDDDDDDDDDEEEEEEEEEEFFFFFFF
006560       -           "GGGGGGGGGHHHHHHHHHIIIIIIIIIJJJJJJJJJKKKKKKKKK
006570       -    "LLLLLLLLLMMMMMMMMM".
```

- Continue the constant through column 71
- Put a “-” in column 7
- Continue constant with a ‘ OR “
- Continue constant in area B

Things That Go in Area A

Area A items:

- Division headers
- Section headers
- Paragraph headers or paragraph names
- Level indicators or level-numbers (01 and 77)
- **`DECLARATIVES`** and **`END DECLARATIVES`**
- End program, end class, and end method markers

Things That Go in Area B

Area B items:

- Entries, sentences, statements, and clauses
- Continuation lines

Things That Go in Area A or B

- Area A or B
- Level-numbers
- Comment lines
- Compiler-directing statements
- Debugging lines
- Pseudo-text

PROGRAM STRUCTURE

```
*****************************************************************
* Author: Cristopher Bohol
* Date: March 29, 2022
* Purpose: Programming Languages Report
* Tectonics: cobc
*****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. HELLO_WORLD.
 ENVIRONMENT DIVISION.
 DATA DIVISION.
 FILE SECTION.
 WORKING-STORAGE SECTION.
 PROCEDURE DIVISION.
 MAIN-DIVISION.
 END PROGRAM HELLO_WORLD.
```

- IDENTIFICATION DIVISION
- ENVIRONMENT DIVISION
- DATA DIVISION
  - FILE SECTION
  - WORKING-STORAGE SECTION
- PROCEDURE DIVISION
  - MAIN-DIVISION

MAIN STRUCTURE OF COBOL

IDENTIFICATION DIVISION

```
IDENTIFICATION DIVISION.
PROGRAM-ID. HELLO.
AUTHOR. JOE SMITH.
INSTALLATION. TSYS.
DATE-WRITTEN. 12/03/2011.
DATE-COMPILED. 12/03/2011.
```

- Only **PROGRAM-ID** is required
- Some interesting parms can be coded on the **PROGRAM-ID**

PROCEDURE DIVISION

- The **PROCEDURE DIVISION** is where you code the executable statements in your COBOL program
- Divided into Paragraphs (terminated with periods):

```
100-MAIN.
        DISPLAY "HELLO…"
        PERFORM 200-SUB
        GOBACK
        .
 200-SUB.
        DISPLAY "…WORLD!"
        .
```

PROCEDURE DIVISION

- To resolve ambiguity caused by not using periods, we will use statement delimiters:

```
END-IF
END-PERFORM
END-COMPUTE
...
```

1-Hello_World.cbl

DIFFERENCES TO OTHER LANGUAGE

JAVA PROGRAM and Output

```java
public class sample{ //PROGRAM ID. sample.
    //MAIN-PROCEDURE
    Run | Debug
    public static void main(String[] args){ //100-MAIN
        System.out.println("Hello..."); //DISPLAY "Hello..."
        print1(); // PERFORM 200-SUB
        print2(); // PERFORM 300-SUB
        return; // GOBACK
    }
    //Can Compared to 200-SUB.
    static void print1(){
        System.out.println("...World!"); //DISPLAY "...World"
    }
    //Can Compared to 300-SUB.
    static void print2(){
        System.out.println("...PHILIPPINES"); //DISPLAY "...PHILIPPINES"
    }
    //END PROGRAM sample
}
```

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL

Hello...
...World!
...PHILIPPINES
```

COBOL PROGRAM and Output

```cobol
      ******************************************************************
      * Author: Cristopher Bohol
      * Date: March 29, 2022
      * Purpose: Programming Languages Report
      * Tectonics: cobc
      ******************************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. HELLO_WORLD.
       PROCEDURE DIVISION.
       MAIN-PROCEDURE.
       100-MAIN.
           DISPLAY "HELLO..."
           PERFORM 200-SUB
           PERFORM 300-SUB
           GOBACK
           .
       200-SUB.
           DISPLAY "...WORLD!".
       300-SUB.
           DISPLAY "...PHILIPPINES".
       END PROGRAM HELLO_WORLD.
```

```
Logs
Compiler    Issues    Output

C:\CS Program Files Only\USJR
HELLO...
...WORLD!
...PHILIPPINES
```

DATA DIVISION

- Used to create variables and constant fields
- Only three data types
  - numeric `PIC 99999.`
  - alphanumeric (text/string) `PIC XXX.`
  - alphabetic `PIC AAA.`
- Level numbers indicate subordination of fields. Use levels 01-49
- Alphabetic is seldom used

DATA DIVISION

We define data used in input-output operations.

```
FILE SECTION.
FD  CUSTOMER-FILE.
01 CUSTOMER-MASTER.
        05  CUST-NUM     PIC 9(2).
        05  CUST-FNAME   PIC X(20).
        05  CUST-LNAME   PIC X(20).
FD  SALES-REPORT.
01   REPORT-AREA     PIC X(132).
```

Level Numbers

- Group item – a subdivided field
- Elementary item – a non-subdivided field
- 01 – Group or independent item
- Higher numbers indicate subordinate fields

```
005100        01  CUST-TABLE.
005200            10 CUST-REC OCCURS 100 TIMES.
005300               20 CUST-NAME.
005400                  30 CUST-L-NAME PIC X(10).
005500                  30 CUST-F-NAME PIC X(10).
005600               20 CUST-BALANCE   PIC S9(7)V99 PACKED-DECIMAL.
005700        01  TEMP-REC                    PIC X(35).
005800        01  I                           PIC S999 PACKED-DECIMAL.
```

Level Numbers

- 66, 77, 88 have special significance
- 66 – Used to rename (no longer used)
- 77 – An independent item (choose 01)
- 88 – Condition name

Level Numbers

```
01   XXX.
     05   YYY.
          10     AAA   PIC X.
          10     BBB   PIC X.
     05   ZZZ    PIC X(20).

77    AAA      PIC 999V99.
```

Picture Clauses

- Picture clause values usually use 9, X, V, S, A
- 9 – a decimal digit
- X – any alphanumeric character
- V – an implied decimal point
- S – a sign
- A – A-Z, and blank

Picture Clauses

- PIC 9(6) // 000000
- PIC 9(6) value 4 // 000004
- PIC 9(6)V99 // 000000.00
- PIC 999999V99 // 000000.00
- PICTURE X(10) // XXXXXXXXXX
- PIC XXXXXXXXXX // XXXXXXXXXX
- PIC S9(4)V9(4) // +0000.0000
- PIC S9999V9999 // +0000.0000
- PIC 9(18) //000000000000000000
- PIC X(4) value “4abc” // 4abc

Numeric Edited Fields

- XXXBXXBXXXX //just a whitespace
- 99/99/99 // 00/00/00
- ZZ,ZZZ.99DB // (5spaces).99(spaces)
- ***,***.99 //******.00
- ----.99 // (4spaces).00
- $$$9.99 //(2spaces)$0.00
- 99999.99 //00000.00

USAGE Clause

- Specifies the format in which data is stored in memory
- Normally, the phrase "**USAGE IS**" is omitted

```
01 FIRST-NAME  USAGE IS DISPLAY PIC X(20).
01 FIRST-NAME  PIC X(20).
```

DATA DIVISION

Define the data needed for internal processing in the **WORKING-STORAGE SECTION**.

Storage is statically allocated and exists for the life of the *run unit*.

```
WORKING-STORAGE SECTION.
01  TOTAL-FIELDS.
        05  CUST-TOTAL     PIC S9(7)V99 VALUE 0. // +0000000.00
        05  COST-TOTAL     PIC  S9(7)V99 VALUE 0. //+0000000.00
01  DATE-AND-TIME.
        05  CD-YEAR        PIC 9999. // 0000
        05  CD-MONTH       PIC 99. // 00
```

DATA DIVISION

- Describe data that exists in another program, or storage you want to associate with a symbolic name in the **LINKAGE SECTION**.

```
LINKAGE SECTION.
01  LK-DATA-AREA
        05   NAME     PIC X(40).
        05   AGE      PIC 999.
```

DATA DIVISION

The **LOCAL-STORAGE SECTION** is used to have storage allocated each time a program is entered, and deallocated on return from the program. Used for compatibility with C or Java.

```
LOCAL-STORAGE SECTION.
01   CUST-NO        PIC X(3).
01   COST           PIC 9(5)V99.
```

Initialization of Storage

- **`WORKING-STORAGE`** for programs is allocated at the start of the run unit.
- Any data items with **`VALUE`** clauses are initialized to the appropriate value at that time.

Group and Data Items

```
01 Customer-Record.
      05 Customer-Name.
           10 Last-Name Pic x(17).
           10 Filler Pic x.
           10 Initials Pic xx.
      05 Part-Order.
           10 Part-Name Pic x(15).
           10 Part-Color Pic x(10).
```

Redefines

```cobol
*****************************************************************
* Author: Cristopher Bohol
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* Tectonics: cobc
*****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. HELLO_WORLD.
 ENVIRONMENT DIVISION.
 DATA DIVISION.
 FILE SECTION.
 WORKING-STORAGE SECTION.
 01 MONTH-AMOUNT.
     05  AMOUNT     PIC X(6) value "abc".
     05  AMOUNTX    REDEFINES AMOUNT PIC X(6).
 PROCEDURE DIVISION.
 MAIN-DIVISION.
     DISPLAY "MONTH-AMOUNT: "MONTH-AMOUNT.
     DISPLAY "AMOUNT: "AMOUNT.
     DISPLAY "AMOUNTX: "AMOUNTX.
 END PROGRAM HELLO_WORLD.
```

```
MONTH-AMOUNT: abc
AMOUNT: abc
AMOUNTX: abc
```

```cobol
 WORKING-STORAGE SECTION.
 01 MONTH-AMOUNT.
     05  AMOUNT     PIC s9(3)v99 values 99.99.
     05  AMOUNTX    REDEFINES AMOUNT.

         10  XFIELD     PIC 9(5).
         10  YFIELD     REDEFINES XFIELD.
             20  A    PIC X(3).
             20  B    PIC X(2).

 PROCEDURE DIVISION.
 MAIN-DIVISION.
     DISPLAY "MONTH-AMOUNT: "MONTH-AMOUNT.
     DISPLAY "AMOUNT: "AMOUNT.
     DISPLAY "AMOUNTX: "AMOUNTX.
     DISPLAY "XFIELD: "XFIELD.
     DISPLAY "YFIELD: "YFIELD.
     DISPLAY "A: "A.
     DISPLAY "B: "B.
 END PROGRAM HELLO_WORLD.
```

```
MONTH-AMOUNT: 09999
AMOUNT: +099.99
AMOUNTX: 09999
XFIELD: 09999
YFIELD: 09999
A: 099
B: 99
```

LITERALS

```cobol
*****************************************************************
* Author: Cristopher Bohol
* Date: March 29, 2022
* Purpose: Programming Languages Report
* Tectonics: cobc
*****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. HELLO_WORLD.
 ENVIRONMENT DIVISION.
 DATA DIVISION.
 FILE SECTION.
 WORKING-STORAGE SECTION.
 01  LITERALS.
     02  SLITERALS   PIC X(30) values "String Literals".
     02  NLITERALS   PIC 9(2) values 56.
 PROCEDURE DIVISION.
 MAIN-DIVISION.
     DISPLAY "LITERAL: "LITERALS.
     DISPLAY "CHARACTER LITERAL: "SLITERALS.
     DISPLAY "NUMBER LITERAL: "NLITERALS.
 END PROGRAM HELLO_WORLD.
```

```
LITERAL: String Literals                    56
CHARACTER LITERAL: String Literals
NUMBER LITERAL: 56
```

Constants

- A *constant* is a data item that has only one value and it can never change
- Unfortunately, COBOL does **not** define a construct specifically for constants
- Moral: All values are subject to change

```
Data Division.
    01 Report-Header pic x(50)
                     value "Company Report".
    01 Interest      pic 9v9999
                     value 1.0265.
```

Figurative Constants

There are some figurative constants supplied by the language:

- `ZERO - an appropriate form of 0`
- `SPACE - x'40'`
- `HIGH-VALUES - binary 1's`
- `LOW-VALUES - binary 0's`
- `QUOTE - a single quote`
- `NULL - binary 0's used for pointers`

TABLES (ARRAYS)

```
      * Author: Cristopher Bohol
      * Date: March 29, 2022
      * Purpose: Programming Languages Report
      * Tectonics: cobc
      ******************************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. HELLO_WORLD.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       FILE SECTION.
       WORKING-STORAGE SECTION.
       01 NEW_TABLE.
           05 WS-A OCCURS 2 TIMES.
               10 WS-B PIC A(10) VALUE 'Sample'.
               10 WS-C OCCURS 2 TIMES.
                   15 WS-D PIC X(6) VALUE 'Table'.

       PROCEDURE DIVISION.
       MAIN-DIVISION.
           DISPLAY "NEW TABLE: "NEW_TABLE.
           DISPLAY "WS-A"WS-A.
       END PROGRAM HELLO_WORLD.
```

'WS-A' requires one subscript

```
      ******************************************************************
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      ******************************************************************
       IDENTIFICATION DIVISION.
       PROGRAM-ID. HELLO_WORLD.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       FILE SECTION.
       WORKING-STORAGE SECTION.
       01 NEW_TABLE.
           05 WS-A OCCURS 2 TIMES.
               10 WS-B PIC A(10) VALUE 'Sample'.
               10 WS-C OCCURS 2 TIMES.
                   15 WS-D PIC X(6) VALUE 'Table'.

       PROCEDURE DIVISION.
       MAIN-DIVISION.
           DISPLAY "NEW TABLE: "NEW_TABLE.
       END PROGRAM HELLO_WORLD.
```

```
NEW TABLE: Sample    Table Table Sample    Table Table
```

2-Variables.cbl

```cobol
*****************************************************************
* Author: Cristopher Bohol
* Date: March 29, 2022
* Purpose: Programming Languages Report
* Tectonics: cobc
*****************************************************************
 IDENTIFICATION DIVISION.
 PROGRAM-ID. DECLARING_VARIABLES.
 DATA DIVISION.
*working storage defines variables
 WORKING-STORAGE SECTION.
*define a number with a sign, 3 numbers, a decimal, and then
*two numbers aafter the decimal. by default it should be 0 filled
 01 FIRST-VAR PIC S9(3)V9(2).
*do the same thing as above but actually initialize
*to a number -123.45
 01 SECOND-VAR PIC S9(3)V9(2) VALUE -123.45.
*defines an alphabetic string and initialize it to abcdef
 01 THIRD-VAR PIC A(6) VALUE 'ABCDEF'.
*define an alphanumeric string and initialize it to a121$
 01 FOURTH-VAR PIC X(5) VALUE 'A121$'.
*create a grouped variable
 01 GROUP-VAR.
     05 SUBVAR-1 PIC 9(3) VALUE 337.
*    create 3 alphanumerics, but use less than
*    the allocated space for each of them
     05 SUBVAR-2 PIC X(15) VALUE 'LALALALA'.
     05 SUBVAR-3 PIC X(15) VALUE 'LALALA'.
     05 SUBVAR-4 PIC X(15) VALUE 'LALALA'.

*print our variables
 PROCEDURE DIVISION.
 DISPLAY "1ST VAR :"FIRST-VAR.
 DISPLAY "2ND VAR :"SECOND-VAR.
 DISPLAY "3RD VAR :"THIRD-VAR.
 DISPLAY "4TH VAR :"FOURTH-VAR.
 DISPLAY "GROUP VAR :"GROUP-VAR.
 END PROGRAM DECLARING_VARIABLES.
```

```
1ST VAR :+000.00
2ND VAR :-123.45
3RD VAR :ABCDEF
4TH VAR :A121$
GROUP VAR :337LALALALA       LALALA         LALALA
```

MOVE STATEMENT

- Used to copy data from one field to another
- Example -

```
MOVE X-FIELD TO Y-FIELD Z-FIELD
```

- Data is copied from the sending field to the receiving field

MOVE STATEMENT

- To move data from one field to another field, the two fields should be “compatible” but don’t have to be identically pictured

- Alphanumeric - `PIC X(10)`
- Numeric - `PIC 999v99`
- Numeric-Edited - `PIC 999.99-`

Compatible moves:

-Alphanumeric to Alphanumeric

-Numeric to Numeric

-Numeric to Numeric edited

MOVE STATEMENT

- **Compatible moves:**

-Alphanumeric to Numeric if the sending field is an unsigned integer

-Alphanumeric to Numeric edited if the sending field is an unsigned integer

-Numeric to Alphanumeric if the sending field is an unsigned integer

MOVE STATEMENT

- If the receiving field is larger than the sending field, the receiving field is filled with leading 0's in a numeric move:

```
01    X   PIC S9(3) VALUE 123.
01    Y   PIC S9(5) VALUE 0.
          MOVE X TO Y
 RESULT:     Y = +00123
```

MOVE STATEMENT

- If the receiving field is larger than the sending field, the receiving field is filled with trailing spaces in a alphanumeric move.

```
01    X   PIC X(3) VALUE “ABC”.
01    Y   PIC X(5) VALUE SPACES.
          MOVE X TO Y
 RESULT:     Y = ABC
```

MOVE STATEMENT

- If the receiving field is smaller than the sending field, data will be truncated on the left for numeric moves and on the right for alphanumeric moves

```
01   X  PIC S9(5) VALUE 12345.
01   Y  PIC S9(3) VALUE 0.
01   A  PIC X(5)  VALUE 'ABCDE'
01   B  PIC X(3)  VALUE SPACES.
        MOVE X TO Y
        MOVE A TO B
 RESULT:    Y = +345
            B = ABC
```

INITIALIZE

- **`SPACE`** is the implied sending item for receiving items of category alphabetic, alphanumeric, alphanumeric-edited, DBCS, national, or national-edited.
- **`ZERO`** is the implied sending item for receiving items of category numeric or numeric-edited.

INITIALIZE

```cobol
WORKING-STORAGE SECTION.
01   X  PIC S9(5) VALUE 12345.
01   Y  PIC S9(3) VALUE 0.
01   A  PIC X(5)  VALUE "ABCDE".
01   B  PIC X(3)  VALUE SPACES.
01   WORK.
     05   A-FIELD   PIC X(3).
     05   B-FIELD   PIC S999V99.
PROCEDURE DIVISION.
MOVE X TO Y.
MOVE A TO B.
MOVE "ABC" TO A-FIELD.
MOVE 123.45 TO B-FIELD.
MOVE LOW-VALUE TO WORK.
MAIN-PROCEDURE.
     DISPLAY "X: "X.
     DISPLAY "Y: "Y.
     DISPLAY "A: "A.
     DISPLAY "B: "B.
     DISPLAY "AFIELD: "A-FIELD.
     DISPLAY "B-FIELD: "B-FIELD.
     DISPLAY "WORK: "WORK.
     INITIALIZE WORK.
     DISPLAY "AFIELD: "A-FIELD.
     DISPLAY "B-FIELD: "B-FIELD.
     DISPLAY "WORK: "WORK.
     STOP RUN.
END PROGRAM YOUR-PROGRAM-NAME.
```

```
X: +12345
Y: +345
A: ABCDE
B: ABC
AFIELD:
B-FIELD: +.00
WORK: 0
AFIELD:
B-FIELD: +000.00
WORK:    00000
```

ADD Semantics

- All identifiers or literals that precede the keyword **`TO`** are added together, and this sum is added to and stored in *identifier-2*. This process is repeated for each successive occurrence of *identifier-2* in the left-to-right order in which *identifier-2* is specified.

```
ADD X Y Z TO  P Q

Before X=1, Y=2, Z=3, P=4,  Q=6

After  X=1, Y=2, Z=3, P=10, Q=12
```

ADD EXAMPLES

```cobol
WORKING-STORAGE SECTION.
01 P PIC 9(2)v9 value 2.1.
01 Q PIC 9(2) value 6.
01 X PIC 9(2) value 81.
01 Y PIC 9(2) value 80.
01 Z PIC 9 value 4.
PROCEDURE DIVISION.
ADD P TO Q
ADD 1 TO Z
ADD P TO Q ROUNDED
ADD X TO Y
    ON SIZE ERROR
       DISPLAY "ADD ERROR"
END-ADD.
DISPLAY "P: ",P " Q: ", Q.
DISPLAY "1: ",1 " Z: ", Z.
DISPLAY "P: ",P " Q: ", Q.
DISPLAY "X: ",X " Y: ", Y.
END PROGRAM YOUR-PROGRAM-NAME.
```

```
ADD ERROR
P: 02.1 Q: 10
1: 1 Z: 5
P: 02.1 Q: 10
X: 81 Y: 80
```

ADD…GIVING Semantics

- All identifiers or literals that precede the keyword **`TO`** are added together, and this sum is added to *identifier-2* to obtain a temporary sum. (Identifier-2 is unchanged)
- The the temporary sum is moved to identifier-3.

```
ADD X Y Z TO V GIVING P
```

Before **`X=1, Y=2, Z=3, V=4, P=6`**

After **`X=1, Y=2, Z=3, V=4, P=10`**

SUBTRACT

- All identifiers or literals preceding the keyword **FROM** are added together and their sum is subtracted from and stored immediately in *identifier-2*. This process is repeated for each successive occurrence of *identifier-2*, in the left-to-right order in which *identifier-2* is specified.

```
SUBTRACT X Y FROM P Q
```

Before: **X=1,Y=2, P=3,Q=4**

After: **X=1,Y=2, P=0,Q=1**

SUBTRACT Semantics

- All identifiers or literals preceding the keyword **`FROM`** are added together and their sum is subtracted from *identifier-2* to obtain a temporary value which is moved to *identifier-3*.

```
SUBTRACT X Y FROM P GIVING Q
```

Before: **`X=1,Y=2,P=5,Q=6`**

After: **`X=1,Y=2,P=5,Q=2`**

MULTIPLY Semantics

- In format 1, the value of *identifier-1* or *literal-1* is multiplied by the value of *identifier-2*; the product is then placed in *identifier-2*. For each successive occurrence of *identifier-2*, the multiplication takes place in the left-to-right order in which *identifier-2* is specified.

```
MULTIPLY X BY P Q
```

Before: **`X=2,P=4,Q=5`**

After: **`X=2,P=8,Q=10`**

MULTIPLY

- In format 2, the value of *identifier-1* or *literal-1* is multiplied by the value of *identifier-2* or *literal-2*. The product is then stored in the data items referenced by *identifier-3*. Identifier-2 is unchanged.

```
MULTIPLY X BY Y GIVING Z
```

Before: **X=2, Y=3, Z=4**

After: **X=2, Y=3, Z=6**

DIVIDE

- In format 1, the value of *identifier-1* or *literal-1* is divided into the value of *identifier-2*, and the quotient is then stored in *identifier-2*. For each successive occurrence of *identifier-2*, the division takes place in the left-to-right order in which *identifier-2* is specified.

```
DIVIDE X INTO Y Z
```

Before: **X=3, Y=7, Z=12**

After: **X=3, Y=2, Z=4**

DIVIDE

- In format 2, the value of *identifier-1* or *literal-1* is divided into the value of *identifier-2* or *literal-2*. The value of the quotient is stored in each data item referenced by *identifier-3*.

```
DIVIDE X INTO Y GIVING Z
```

Before: `X = 2, Y = 13, Z = 1`

After: `X = 2, Y = 13, Z = 6`

DIVIDE

- In format 3, the value of *identifier-1* or *literal-1* is divided by the value of *identifier-2* or *literal-2*. The value of the quotient is stored in each data item referenced by *identifier-3*.

```
DIVIDE X BY Y GIVING Z
```

Before: `X = 10, Y = 3, Z = 1`

After: `X = 10, Y = 3, Z = 3`

DIVIDE

- In format 4, the value of *identifier-1* or *literal-1* is divided into *identifier-2* or *literal-2*. The value of the quotient is stored in *identifier-3*, and the value of the remainder is stored in *identifier-4*.

```
DIVIDE X INTO Y
       GIVING Z

       REMAINDER R
```

Before: **X = 2, Y = 9, Z = 8, R = 7**

After: **X = 2, Y = 9, Z = 4, R = 1**

COMPUTE

- **COMPUTE** can be used to initialize a numeric field
- Usually reserved for nontrivial computations. For simple computations choose **ADD, SUBTRACT, MULTIPLY or DIVIDE**

```
05  X   PIC    S9(4)V9.
COMPUTE X ROUNDED = (A + B) / 2.3
          ON SIZE ERROR
          DISPLAY "X WAS TRUNCATED"
END-COMPUTE
```

Arithmetic Operators

Operation	Operator
+	Addition
-	Subtraction
*	Multiplication
/	Division
**	Exponentiation

Parentheses provide precedence.

Always parenthesize!

```
((X + Y) * ( Z ** 3))
```

ACTIVITY: CALCULATOR (3-Common_Verbs.cbl)

Make a Calculator Program using COBOL.

- Just Use the 4 Common Verbs (Multiply, Add, Divide and Add).
- Display the Value
- You can use the online compiler to run the program.
- Send the PDF file after clicking the Pretty Print

Online COBOL Compiler IDE

```
IDENTIFICATION DIVISION.
PROGRAM-ID. HELLO_WORLD.
PROCEDURE DIVISION.
MAIN-DIVISION.
100-MAIN.
   DISPLAY "HELLO..."
   PERFORM 200-SUB
   PERFORM 300-SUB
   GOBACK
   .
200-SUB.
   DISPLAY "...World!".
300-SUB.
   DISPLAY "...PHILIPPINES".

END PROGRAM HELLO_WORLD.
```

Execute Mode, Version, Inputs & Arguments

GNU COBOL 3.1.2

Interactive

Stdin Inputs

CommandLine Arguments

Execute

Result

CPU Time: 0.00 sec(s), Memory: 6808 kilobyte(s)

```
HELLO...
...World!
...PHILIPPINES
```

- New Project/ Clear All
- My Projects
- Execute History
- Collaborate/Peer Programming
- Save
- Save As
- Editable Share - Embed in a Blog or Site
- Instant Share - Embed (No Login/Save required)
- Copy to Clipboard
- Dark Theme
- Font Size 12
- Open (from local file)
- Save (to local file)
- Pretty Print
- How To / FAQ

CLICK ME!

LINK: Online COBOL Compiler - Online COBOL Editor - Run COBOL Online - Online COBOL Runner (jdoodle.com)

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Standards based REST API

Goto API

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Groovy	Fortran	Brainf**k
Hack	TCL	Lua
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D	Dart	YaBasic
Free Basic	Clojure	Verilog
NodeJS	Scheme	Forth
Prolog	Bash	COBOL
OCTAVE/ Matlab	Icon	CoffeeScript
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Intercal	Nemerle	Ocaml
Unlambda	Picolisp	CLISP
Elixir	SpiderMonkey	Rhino JS
BC	Nim	Factor
Falcon	Fantom	Pike
Go	OZ-Mozart	LOLCODE
Racket	SmallTalk	Whitespace
Erlang	J Lang	Assembler (FASM)
AWK	Algol 68	Befunge
Haxe	J Bang	HTML & Javascript

LINK: Online Compiler and Editor/IDE for Java, C/C++, PHP, Python, Perl, etc (jdoodle.com)

SAMPLE FORMAT OF FILE SUBMISSION

JDOODLE

Online COBOL Compiler IDE

```
IDENTIFICATION DIVISION.
PROGRAM-ID. HELLO_WORLD.
PROCEDURE DIVISION.
MAIN-DIVISION.
100-MAIN.
   DISPLAY "HELLO..."
   PERFORM 200-SUB
   PERFORM 300-SUB
   GOBACK
   .
200-SUB.
   DISPLAY "...World!".
300-SUB.
   DISPLAY "...PHILIPPINES".

END PROGRAM HELLO_WORLD.
```

Execute Mode, Version, Inputs & Arguments

CommandLine Arguments

Stdin Inputs

Result

CPU Time: 0.00 sec(s), Memory: 6808 kilobyte(s) compiled and executed in 0.655 sec(s)

```
HELLO...
...World!
...PHILIPPINES
```

FINAL NOTE:

For Questions and Clarifications:
Welcome to COBOL-Programming-Languages-Code-Summary Discussions! · Discussion #1 · cristoph143/COBOL-Programming-Languages-Code-Summary (github.com)
For IDE:
OpenCobolIDE project files : OpenCobolIDE (launchpad.net)

For Online Compiler:

Online COBOL Compiler - Online COBOL Editor - Run COBOL Online - Online COBOL Runner (jdoodle.com)

For Format:

https://github.com/cristoph143/COBOL-Programming-Languages-Code-Summary.git

REFERENCES

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- History of COBOL – Joysis Tech Voc Inc (joysistvi.edu.ph)
- https://qph.fs.quoracdn.net/main-qimg-06fb1e469419f1501f8fd08ea8a2b18b-c
- https://deidreadams.com/wp-content/uploads/2014/01/Code002.jpg
- The USING phrase - IBM Documentation

Thank You