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Agenda

- Rexx Overview and Related Topics
- Creating and Executing Rexx Programs
- Rexx Language
  - Basic Syntax
  - Strings, Operators, Expressions
  - Tracing, Parsing
  - Issuing Commands and use of Pipelines
  - Control Constructs
  - Subroutines & Functions
- Lab Exercises
Rexx Overview

- **RE**structured **eXtended eXecutor**

- Rexx is a procedural, general purpose language
  - Intuitive - easy to use and read
  - Many uses, ranging from:
    - Personal tools and utilities
      - For example, frequently used command sequences
    - Complex applications and licensed programs
  - Available on many IBM and non-IBM platforms

- Rexx is designed to be *interpreted*
  - Each program statement translated and executed as the program runs
  - Programs can also be *compiled* to improve
    - Performance
    - Security
    - Change control
Rexx Overview (cont.)

- Few restrictions on program format
  - Indentation
  - 1 or more clauses on a line
  - /* comments can be anywhere and any length */
  - *implied* semicolon delimiters at end of lines
  - Comma (,) as a continuation character

- Nothing to Declare!
  - May document and initialize variables, but…
  - Implicit declarations take place during execution
  - **labels**: are the only true declarations
Rexx Platforms

- IBM Platforms
  - VM
  - TSO/E (z/OS)
  - VSE
  - AIX
  - OS/2

- Object Rexx
  - Object-Oriented Rexx supporting many utilities for a UNIX-type environment, including Linux for System z

- Regina Rexx
  - Rexx interpreter ported to most UNIX platforms, including Linux

- NetRexx
  - Blend of Rexx and Java; compiles into Java classes

- Language concepts are the same on all platforms
  - Minor differences such as file names and structure
  - Operating system-specific tools that support Rexx

(See references page for website information)
Creating Rexx Programs: z/VM

- Create a file with filetype of EXEC using XEDIT, the CMS editor

  XEDIT  myrexx exec a

- Rexx programs begin with a comment line:

  /*  beginning of program  */               /* Rexx */

- Can be run uncompiled and interpreted, or compiled with the Rexx compiler
Executing Rexx Programs: z/VM

- Search order
  - Same for both compiled and interpreted execs
  - Loaded and started through CMS EXEC handler
  - Normal CMS Command search order: EXECs, synonyms, MODULEs...

- Invocation
  - Invoke as a CMS command or EXEC:
    - `myexec`
    - `exec myexec`

- Implied exec (IMPEX) settings control whether exec files are treated as commands
  - SET IMPEX ON|OFF (default is ON)
  - QUERY IMPEX
Creating and Executing Rexx Programs: TSO/E

- REXX exec can be a sequential data set or a PDS member
- TSO/E EXEC command to invoke a REXX program or a CLIST
- Three ways to use the EXEC command:
  - Explicit execution:
    `EXEC dataset(member) 'parameters' operands`
  - Implicit execution:
    `membername parameters`
  - Extended implicit execution:
    `%membername parameters`

- Search includes:
  - `//SYSEXEC DD` concatenation
  - `then` then
  - `//SYSPROC DD` concatenation for `membername` on the command line
Lab Exercises: What to Expect…

1. Run an existing Rexx program to create temporary disk space

2. Write a program to accept an input argument, prompt for data, and display results

3. Trace and Debug existing Rexx programs

4. Write a program to obtain z/VM CP level information
   *(issues commands and Diagnose 8)*

5. Write a program to locate an available CMS file mode and define a temporary disk at that file mode
   *(uses a subroutine, Pipelines, stems, and various control constructs)*
Helpful Hints for Exercises

- List Files on A-disk:
  
  ```
  FILELIST ** A  or...  LISTFILE ** A
  ```

- XEDIT a file
  
  ▶ from command line:
  
  ```
  Xedit Filename Filetype Filemode
  ```

  ▶ from prefix area on Filelist Screen, PF11 or :
  
  ```
  x  PROFILE EXEC  A1 V  75  74  1  09/17/07 15:48:18
  ```

- Prefix area commands within the file:
  
  - **a** add (insert) a single line to the file
  - **d** delete a line (d5 deletes 5 lines)
  - **m** move a line (f following or p preceding)
  - **c** copy a line (f following or p preceding)
  - **mm…mm** block move, **dd…dd** block del, **cc…cc** block copy

- Leaving XEDIT:
  
  - **FILE** to save changes
  - **QQUIT** to exit without saving changes
Helpful Hints for Exercises (cont.)

- Screen execution modes
  - CP Read
    - CP is waiting for a command
  - VM Read
    - CMS is waiting for a command
  - Running
    - System is ready for commands or is working on some
  - More …
    - More information than can fit on the screen is waiting to be displayed
      - Clear screen manually or let CP clear after x seconds determined by TERM command setting
  - Holding
    - Waiting for you to clear screen manually
  - Not Accepted
    - Too many commands in buffer; wait for executing command to complete
Logging on to the z/VM Lab System

- 3270 Session
- Userids
- Password
Exercise 1: Create Temp Disk Space

1. Logon to your VM lab userid
2. Issue command **QUERY DISK** to see which disks are accessed
3. Run existing exec **GETTEMP mode** (*mode* is input parameter) to:
   - create a temporary disk at filemode *mode*
   - copy existing EXEC programs from a-disk to new temp disk
4. Issue **QUERY DISK** again – notice new disk at *mode*
5. Issue command **FILELIST ** *mode*
6. Run **GETTEMP** again with mode *a*
7. Issue **QUERY DISK** again – notice new disk at mode *a*
8. **LOGOFF**
Exercise 1: Create Temp Disk Space

/* Get Temporary disk space */

/* File mode of temporary disk is input argument */

parse upper arg fmode rest
If (fmode = '') | (rest ≠= '') then
  Do
    say ''
    say 'ERROR: Input parm is FILEMODE.'
    say ''
    exit 4
  End

'CP DETACH 555' /* Get rid of old disk */
'CP DEFINE T3390 555 2' /* Define 2 cylinders of temp space */

queue 1 /* Answer YES to FORMAT prompt */
queue TMP555 /* Disk label is TMP555 */
'FORMAT 555 'fmode /* Format the disk for CMS files */

If (fmode = 'A') Then /* If input mode is "A" move A disk to B */
  Do
    Parse Value Diag(8,'QUERY 'UserId()) With thisuser .
    'access VMSYSU:'thisuser'. b/a'
    frommode = 'b'
  End
Else frommode = 'a'

'COPYFILE * exec ' frommode '=' fmode /* COPY existing EXEC files to new temp disk */
exit 0
Exercise 1: Create Temp Disk Space - Answer

query disk

<table>
<thead>
<tr>
<th>LABEL</th>
<th>VDEV</th>
<th>M</th>
<th>STAT</th>
<th>CYL</th>
<th>TYPE</th>
<th>BLKSZ</th>
<th>FILES</th>
<th>BLKS</th>
<th>USED- (%)</th>
<th>BLKS LEFT</th>
<th>BLK TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>DIR</td>
<td>A</td>
<td>R/W</td>
<td>-</td>
<td>-</td>
<td>4096</td>
<td>44</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>MNT190</td>
<td>190</td>
<td>S</td>
<td>R/O</td>
<td>115</td>
<td>3390</td>
<td>4096</td>
<td>694</td>
<td>14562-70</td>
<td>6138</td>
<td>20700</td>
<td></td>
</tr>
<tr>
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<td>R/O</td>
<td>355</td>
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<td>4096</td>
<td>1875</td>
<td>49995-78</td>
<td>13905</td>
<td>63900</td>
<td></td>
</tr>
</tbody>
</table>

gettemp z

HCPDTV040E Device 0555 does not exist
DASD 0555 DEFINED
DMSFOR603R FORMAT will erase all files on disk Z(555). Do you wish to continue?
Enter 1 (YES) or 0 (NO).
DMSFOR605R Enter disk label:
DMSFOR733I Formatting disk Z
DMSFOR732I 2 cylinders formatted on Z(555)

query disk

<table>
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<tr>
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<th>CYL</th>
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<td>TMP555</td>
<td>555</td>
<td>Z</td>
<td>R/W</td>
<td>2</td>
<td>3390</td>
<td>4096</td>
<td>19</td>
<td>60-17</td>
<td>300</td>
<td>360</td>
<td></td>
</tr>
</tbody>
</table>
Exercise 1: Create Temp Disk Space – Answer..

gettemp a

DASD 0555 DETACHED
DASD 0555 DEFINED
DMSFOR603R FORMAT will erase all files on disk A(555). Do you wish to continue?
Enter 1 (YES) or 0 (NO).
DMSFOR605R Enter disk label:
DMSFOR733I Formatting disk A
DMSFOR732I 2 cylinders formatted on A(555)

query disk

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<td>3390</td>
<td>4096</td>
<td>19</td>
<td>60-17</td>
<td>300</td>
<td>360</td>
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<td>-</td>
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Rexx Language Syntax

- **Case Insensitivity**
  - `SanFrancisco` is the same as `sanfrancisco`
  - specific support for upper and lower case is provided
  - cases in quoted strings are respected

- **All Rexx programs must begin with a comment**
  ```
  /* This is a comment */
  ```

- **Long lines are common**
  - Continuation with commas
    ```
    say 'This text is continued ',
    'on the next line'
    ```
  - May wrap as a long single line (*but don’t do this*)
    ```
    say 'This text is continued
      on the next line'
    ```
Rexx Strings

- Literal strings: Groups of characters inside single or double quotation marks
  
  "Try a game of blackjack", 'and beat the odds!'

- Two " or ' indicates a " or ' in the string
  
  'Guess the dealer''s top card'
  "The dealer''s card is an Ace"

- Hexadecimal strings: Hex digits (0-9,a-f,A-F) grouped in pairs:
  
  '123 45'x is the same as '01 23 45'x

- Binary strings: Binary digits (0 or 1) grouped in quads:
  
  '10000 10101010'b is the same as '0001 0000 1010 1010'b
Operators & Expressions

- String Expressions

  *(blank)*  "SHARE"  "San Francisco"  -->  "SHARE San Francisco"
  ||  'China'||'town'  -->  'Chinatown'

  *(abuttal)*  abc = 'China'
              abc'town'  -->  'Chinatown'

- Arithmetic Expressions

  +  -  *  /  % (int division)  // (remainder)
  ** (power)  Prefix -  Prefix+
Input and Output

- **say [expression]**
  - writes output to the user's terminal
    
    ```
    say 'Five Euros equals ',
    5 * 1.35 'USD'
    ```

- **pull**
  - prompts for input from the user
    
    ```
    pull rate
    say 'Five Euros equals' 5 * rate 'USD'
    ```

- **parse arg**
  - collects arguments passed to a Rexx Program
    - Invoke program: `EXAMP input1 dataX moreData`
      ```
      parse arg A1 A2 A3
      say A1 A2 A3
      ```
    - Result:
      ```
      input1 dataX moreData
      ```
Operators & Expressions

- Comparative Expressions
  - Normal
    - = \= <> >> > < >= <=
    - comparison is case sensitive
    - leading/trailing blanks removed before compare
    - shorter strings padded with blanks on right
  - Strict
    - == \== >> << >>= <<=
    - comparison is case sensitive
    - if 2 strings = except one is shorter, the shorter string is less than the longer string

- Logical Expressions
  - & | &&
  - \\ (preceding expression)
  - Note: the "not" sign and backslash " \ " are synonymous
Numbers

- A Rexx character string that includes 1 or more decimal digits with an optional decimal point
  - May have leading and trailing blanks
  - Optional sign + or -
  - An "E" specifies exponential notation
    - Be careful with device addresses such as 1E00 (use quotes)

- Precision in calculations may be controlled by the NUMERIC DIGITS instruction
  - Default is 9 digits

- Examples (could also be enclosed in quotes):
  - 12
  - -17.9
  - + 7.9E5
Variables

- Data known by a unique name whose value may change
- Variable names
  - **NOT** case sensitive
  - **Cannot** begin with a digit 0-9
- Defined by assignment (give it a value)
  
  \[
  \text{population} = 184627
  \]
- Variables with no assigned value will have the uppercase variable name as its initial value
- Special variables: **rc, result, sigl**
  - may be set automatically during program execution
Parsing Strings

- Parse Arg – takes data passed into exec or internal routine
  - (see example on “Input and Output” chart)
- Parse Var – parses variable into other variable(s)
Parsing Strings...

- Assigns data to variables using parsing rules

```
str1 = 'February 3-8, 2013'

parse var str1 w1 w2 w3
  ● w1 = February
  ● w2 = 3-8,
  ● w3 = 2013

parse upper var str1 w1 . w2
  ● w1 = FEBRUARY
  ● w2 = 2013

parse var str1 w1 w2
  ● w1 = February
  ● w2 = 3-8, 2013
```
Parsing Strings…

- Default token delimiter is a blank
  - May be changed on Parse statement

```
str1 = 'February*3-8,*2013'
parse var str1 w1 '*' w2 '*' w3

- w1 = February
- w2 = 3-8,
- w3 = 2013
```
Exercise 2: Say, Pull, & Passing Parameters

- Assume a card deck with suits of Hearts, Diamonds, Clubs, and Spades

- Write a Rexx program to:
  - pass in 1 of the 4 suits as an argument
  - prompt for a number from 2-10
  - display the number and the suit in the format:
    "Your card is a 10 of Hearts"

- Run the program with different suits and numbers
Exercise 2: Say, Pull, & Passing Parameters - Answer

/* */
parse arg suit
say 'Enter a number from 2-10:'
pull num
say 'Your card is a 'num' of ' suit
Tracing

- **Trace All** - clauses before execution
- **Trace Commands** - commands before execution. If the command has an error, then also displays the return code
- **Trace Error** - any command resulting in an error after execution and the return code
- **Trace Failure/Normal** – default setting, any command with a negative return code after execution, and the return code
- **Trace Intermediates** – Trace All, plus intermediate results during evaluation of expressions and substituted names
- **Trace Labels** - only labels passed during execution
- **Trace Off** - traces nothing and resets options
- **Trace Results** – Trace All, plus results of an evaluated expression and values assigned during PULL, ARG, and PARSE instructions
- **Trace Scan** – Trace All, but without the clauses being processed
Tracing (cont.)

- output identifier tags:
  - **-* source of a single clause
  - >>> result of expression
  - >.> value assigned to placeholder
  - +++ error messages

- prefixes if TRACE Intermediates in effect:
  - >C> data is compound variable
  - >F> data is result of func call
  - >L> data is a literal
  - >O> data is result of operation on 2 terms
  - >P> data is result of prefix op
  - >V> data is contents of variable
Tracing (cont.)

- Prefix Options `!` and `?` modify tracing and execution
  - `?` controls interactive debugging
    - `TRACE ?Results`
  - `!` inhibits host command execution
    - `TRACE !C` causes command to be traced but not processed

- CMS command `SET EXECTRAC ON` allows you to switch tracing on without modifying the program

- `TS` and `TE` immed commands turn tracing on/off asynchronously
Tracing - Example

- **Program**
  
  ```c
  /* Trace Sample Program */
  Trace Intermediates
  number = 1/7
  say number
  ```

- **Output**
  
  ```plaintext
  3  *--* number = 1/7
  >L>   "1"
  >L>   "7"
  >O>   "0.142857143"
  4  *--* say number
  >V>   "0.142857143"
  0.142857143
  ```
Exercise 3: Tracing and Debugging

The following Rexx Programs are on your VM A-disk:

- REXXEX3A.EXEC
- REXXEX3B.EXEC

There is something wrong with each program

- Using the TRACE instruction, debug each problem
- Fix the code so that it functions properly
Exercise 3: Tracing and Debugging – Answer A

Trace Intermediate output:

6 *-- string1 = "Rexx" 'Lab'
    >L>   "Rexx"
    >L>   "Lab"
    >O>   "Rexx Lab"
7 *-- say string11
    >L>   "STRING11"

STRING11
    9 +++ string2 = "Exerc"|"ise'say string2
Error 6 running REXXTR3A EXEC, line 9: Unmatched "*/" or quote
**Exercise 3: Tracing and Debugging – Answer A**

**Corrected Rexx Program:**

Trace I

```rexx
string1 = "Rexx" 'Lab'
say string1 /* Was: say string1 */

string2 = "Exerc"||"ise" /* Was: string2 = "Exerc"||"ise' */
say string2
```

**Result:**

```plaintext
6 *--* string1 = "Rexx" 'Lab'
   >L> "Rexx"
   >L> "Lab"
   >O> "Rexx Lab"

7 *--* say string1
   >V> "Rexx Lab"

Rexx Lab

9 *--* string2 = "Exerc"||"ise"
   >L> "Exerc"
   >L> "ise"
   >O> "Exercise"

10 *--* say string2
   >V> "Exercise"
```

Exercise
Exercise 3: Tracing and Debugging – Answer B

Trace Intermediate output:

7 *-* Nums = "25 35 71"
   >L>   "25 35 71"

9 *-* parse arg w1 . w2 w3
   >>>   ""
   >.>   ""
   >>>   ""
   >>>   ""
   >>>   ""

11 *-* $average = (w1 + w2 + w3) // 3
   >V>   ""
   >V>   ""
   >V>   ""

11 +++ $average = (w1 + w2 + w3) // 3

DMSREX476E Error 41 running REXXTR3B EXEC, line 11: Bad arithmetic conversion
Exercise 3: Tracing and Debugging – Answer B

**Corrected Rexx Program:**

Trace I  
Nums = "25 35 71"

parse var Nums w1 w2 w3  /* Was: parse arg w1 . w2 w3 */

$average = (w1 + w2 + w3) / 3  /* Was: (w1 + w2 + w3) // 3 */
say "The average value of these numbers is" $average "."
Exercise 3: Tracing and Debugging – Answer B

Result:

7 **--** Nums = "25 35 71"
   >L>   "25 35 71"
9 **--** parse var Nums w1 w2 w3
   >>>   "25"
   >>>   "35"
   >>>   "71"
11 **--** $average = (w1 + w2 + w3) / 3
   >V>   "25"
   >V>   "35"
   >O>   "60"
   >V>   "71"
   >O>   "131"
   >L>   "3"
   >O>   "43.6666667"
12 **--** say "The average value of these numbers is" $average "."
   >L>   "The average value of these numbers is"
   >V>   "43.6666667"
   >O>   "The average value of these numbers is 43.6666667"
   >L>   "."
   >O>   "The average value of these numbers is 43.6666667 ."

The average value of these numbers is 43.6666667 .
Symbols and Stems

- Constant symbol starts with a digit (0-9) or period:
  
  \[77 \quad .123 \quad 12E5\]

- Simple symbol does not start with a digit and does not contain periods:
  
  \[ABC \quad ?3\]

- Compound symbol contains at least one period, and at least 2 other characters
  
  - **Stem** (up to 1st period), followed by **tail**
    
    \[ABC.3 \quad Array.i \quad Total.$name \quad x.y.z\]
Symbols and Stems...

/* Stems as arrays */

    do i=1 to 50 by 1
        array.i = i+5
    end
    say array.25    /* Output: "30" */
say array.51     /* Output: "ARRAY.51" */

/* Stems as records */

    If attendee.payment == "LATE" then
do
    say attendee.$fullname
    say attendee.$email
    say attendee.$company.telephone
end
Issuing Commands from Rexx

- CP and CMS commands can be issued as a quoted string:
  - 'CP QUERY CLEVEL'
  - 'STATE PROFILE EXEC'

- Use DIAG function to issue CP commands with Diagnose x'08'
  - DIAG(8, 'QUERY CLEVEL')
    - Can be an expression as part of a longer statement
    - PARSE command output or parts of command output into variables

- Environment is selected by default on entry to a Rexx program
  - ADDRESS instruction can change the active environment
  - ADDRESS( ) built-in function used to get name of the currently selected environment
Issuing Commands – z/VM Example

Address CMS  /* send cmds to CMS */
   'STATE PROFILE EXEC'

If RC=0 Then  /* file found */
   'COPY PROFILE EXEC A TEMP = ='

   /* Save command output in variable */
Parse Value diag(8,'QUERY CPLEVEL') With queryout
say queryout

z/VM Version 6 Release 2.0, service level 1101 (64-bit)
Generated at 05/09/12 19:47:52 EDT
IPL at 06/03/12 16:29:17 EDT
Issuing Commands – TSO

"CONSOLE ACTIVATE"
...

ADDRESS CONSOLE  /* change environment to CONSOLE for all commands */
"mvs_cmd"
...
"mvs_cmd"

ADDRESS TSO tso_cmd  /* change environment to TSO for one command */
...
"mvs_cmd"

ADDRESS TSO  /* change environment to TSO for all commands */
"tso_cmd"
...

"CONSOLE DEACTIVATE"
Using Pipelines with Rexx

- PIPE is a command that accepts *stage* commands as operands
  - Stages separated by a character called a *stage separator*
    - Default char is vertical bar | \(x'4F'\)

- Allows you to combine programs so the output of one serves as input to the next
  - Like pipes used for plumbing: data flows through programs like water through pipes!

- User-written stages are Rexx programs
  - Reads in data, works on it, places it back into pipe
Using Pipelines with Rexx - Examples

- Invoking from CMS command line:
  ```
  pipe < profile exec | count lines | console
  ```

- Invoking from an Exec:
  ```
  /* Count number of lines in exec */
  'PIPE < profile exec | count lines| console'

  /* or ... on multiple lines */
  'PIPE < profile exec',
      ' count lines',
      ' console'
  ```
Using Pipelines with Rexx - Examples

- Invoking commands and parsing output into a stem:

```rexx
'pipe',
'CMS LISTFILE * EXEC A', /* issue cmd */
'  SPECTS 1 1 ', /* parse first word */
'  STEM response.' /* save in stem */

do i = 1 to response.0
   say response.i /* display file names */
end
```
Control Constructs – DO…END

DO … END can be used to create a code block

```plaintext
if wins > losses then
    do
        say 'Congratulations!'
        say 'You have won!'
    end
else say 'Sorry, you have lost'
```
Control Constructs - Selection

if wins > losses then say 'you have won'
   else say 'you have lost'

select
   when wins > losses then say 'winner'
   when losses > wins then say 'loser'
   otherwise say 'even'
end

select
   when wins > losses then say 'winner'
   when losses > wins then say 'loser'
   otherwise NOP
end
Control Constructs – DO Loops

do forever
  say 'You will get tired of this'
end

do 3
  say "Roll, Roll, Roll the dice"
end

do i=1 to 50 by 1
  say i
  say i
end
More DO Loops

i=30
do until i > 21 /* Evaluate after DO executes */
i=i+5
end
say i → 35

i=30
do while i < 21 /* Evaluate before DO executes */
i=i+5
end
say i → 30
Iterate, Leave, and Exit

- **Iterate** causes a branch to end of control construct

  ```
  do i=1 to 4
    if i=2 then iterate
    say i
  end
  ```

- **Leave** exits the control construct and continues the REXX program

  ```
  do i=1 to 4
    say i
    if i=3 then leave
  end
  say 'I''m free!'
  ```

- **Exit** exits the REXX program unconditionally

  ```
  i=1
  do forever
    say i
    if i=3 then exit
    i=i+1
  end
  say 'I''m free!'
  ```
Built-In Functions

\[
\text{ABS}(-1.674) \rightarrow 1.674
\]
/* absolute value */

\[
\text{C2D('a')} \rightarrow 129 \quad \text{D2X(129,2)} \rightarrow '81'
\]
/* char to decimal, dec to hex*/

\[
\text{DATATYPE('10.5','W')} \rightarrow '0'
\quad \text{DATATYPE('12 ')} \rightarrow 'NUM'
\]
/* determines if a string matches a provided type */

\[
\text{DATE('U')} \rightarrow '02/05/13'
\]
/* date function */

\[
\text{LENGTH('abcdef')} \rightarrow 6
\]
/* length of the string */
Built-In Functions

POS('day','Wednesday') → 7
/* starting position of substr inside a string */

RIGHT('12',4,'0') → '0012'
/* pad 12 out to 4 characters with 0’s */

SUBSTR('abcdef',2,3) → 'bcd'
/* obtain substring of 3 characters beginning at second character */

WORDS('are we done yet?') → 4
/* return number of tokens inside a given string */

WORDPOS('the','now is the time') → 3
/* return position of a given substring */
/* inside a string */
Subroutines & Procedures

- **CALL** instruction is used to invoke a routine
  - May be an internal routine, built-in function, or external routine
- May optionally return a result
  
  ```
  RETURN expression
  ```
  - variable `result` contains the result of the expression
- Parameters may be passed to the called routine
  
  ```
  CALL My_Routine parm1
  ```
  ...which is functionally equivalent to the clause:

  ```
  NewData = My_Routine(parm1)
  ```
- Variables are global for subroutines, but not known to procedures unless passed in or EXPOSE option used
Subroutine Example: Returning a Value

/* subroutine call example */
x = 5
y = 10
Call Calc x y               /* call subroutine Calc */
If result > 50 Then
   say "Perimeter is larger than 50"
Else
   say "Perimeter is smaller than 50"
exit

Calc:                     /* begin subroutine */
Parse Arg len width      /* input args */
return 2*len + 2*width   /* calculate perimeter */
   /* ...and return it */
Exercise 4: WHATCP EXEC

- Write Rexx program WHATCP EXEC to show z/VM CP Level information
  - Issue CP command **QUERY CPLEVEL** to display CP level
  - Use **Rexx Diag** function to issue **QUERY CPLEVEL** command
    - Parse command output to display CP Version, Release, and Service level
Exercise 5: GETTMODE EXEC

- Write Rexx program GETTMODE to locate the first available file mode (A-Z) and create a temporary disk at that file mode

1. **Call a subroutine** that will:
   - Use a PIPE to **issue CMS command** QUERY SEARCH to obtain the used modes (file mode is 3rd word of response) – **save in stem**
   - **Build a string** of used modes from the **output stem** of the PIPE
   - **Create a string** of possible file modes (A-Z)
   - **Build a stem** containing the possible file modes
   - **Mark** the used file modes "unavailable" in the list of possible modes
     - *(Hint: blank out the unavailable modes in the list)*
   - **Locate** the first available mode and return it to the main program

2. **If a file mode is returned:**
   - **Issue commands** to define and format a temporary disk at the returned mode
     *(Hint: Use commands from GETTEMP EXEC)*
Exercise 4: WHATCP – Answer

/* Display CP Level information for the z/VM system */

'CP QUERY CPLEVEL'

Parse value diag(8,'QUERY CPLEVEL') with ,
   . . version . release . '),' . . servicelvl .

say 'z/VM Version = ' version
say 'z/VM Release = ' release
say 'Service Level = ' servicelvl
Exercise 5: GETTMODE EXEC – Answer (1 of 3)

/* Get temporary disk space and access it at an available file mode */

'CP DETACH 555' /* Get rid of old disk */

/* Call subroutine Findmode to locate the first available file mode. */
/* Once found, define a temporary disk and format and access it at */
/* the returned file mode. */

Call Findmode

If rtnmode <> 0 Then
    Say 'Temp disk will be accessed at mode' rtnmode
Else
    Do
        Say 'No Filemodes available for temp disk'
        Exit 8
    End

'CP DEFINE T3390 555 2' /* Define 2 cylinders of temp space */

queue 1 /* Answer YES to FORMAT prompt */
queue TMP555 /* Disk label is TMP555 */
'FORMAT 555 'rtnmode /* Format the disk for CMS files */

Exit rc
Exercise 5: GETTMODE EXEC – Answer (2 of 3)

/* Subroutine Findmode will locate the first available (A-Z) file mode. */
/* and return it in variable rtnmode. If no file modes are available, */
/* rtnmode will be set to zero. */
Findmode:
   'PIPE',
   'CMS QUERY SEARCH',
   'SPEC WORDS 3 1',
   'STEM usedmode.'

/* Build string of accessed file modes */
acc_modes = ''
Do I = 1 TO usedmode.0
   acc_modes = acc_modes || SUBSTR(usedmode.I,1,1)
End

/* Build stem containing all possible file modes */
possible_modes = 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
Do i = 1 TO 26
   modelist.i = SUBSTR(possible_modes,i,1)
End

/* Remove all accessed file modes from possible file mode list */
mlength = LENGTH(acc_modes)
Do n = 1 TO mlength
   Do i = 1 TO 26
      If (SUBSTR(acc_modes,n,1) = modelist.i) Then
         Do
            modelist.i = ''
            Leave
         End
   End
End


Exercise 5: GETTMODE EXEC – Answer (3 of 3)

/* Locate the first possible file mode that is "available" and */
/* return it                                                    */

foundmd = 'NO'
Do i = 1 TO 26
   If modelist.i ≠ '' Then
      Do
         rtnmode = modelist.i
         foundmd = 'YES'
      Leave
   End
End

/* If no file modes available, return zero                      */

If foundmd = 'NO' Then
   rtnmode = 0

Return
Exercise 5: GETTMODE EXEC – Alternate Answer

FINDMODE: procedure

'Pipe',
' literal A B C D E F G H I J K L M N O P Q R S T U V W X Y Z',
' Split ',
' Spec 1.1 13',
' Append CMS Q disk *'
' Nlocate 8.4 /VDEV/',
' Spec 13.1',
' Sort ',
' Unique Single ',
' Take 1',
' Var freefm'
For More Information...

- **Websites:**
    Rexx webpage
    Netrexx
    Object Rexx
  - http://regina-rexx.sourceforge.net/  
    Regina Rexx

- **z/VM publications:**
  - Rexx/VM Reference - SC24-6113
  - Rexx/VM User's Guide - SC24-6114

- **z/OS publications:**
  - TSO/E Rexx Reference - SC28-1975

- **Rexx Compiler**
  - Products ordered separately from z/VM:
    - REXX/370 Compiler, 5695-013
    - REXX/370 Library, 5695-014

- **Other books:**
  - The Rexx Language  
  - The Netrexx Language  

- **List servers:**
  - http://listserv.uark.edu/scripts/wa.exe?A0=ibmvm
Efficiency of One. Flexibility of Many.
40 Years of Virtualization.