Exercise Guide

Getting Started on Mainframe with z/OS Commands and Panels

IBM **Training**

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Exercise 1. System Familiarization

Estimated time

00:45

Overview

The steps in this exercise are to guide you through accessing the Skytap environment to gain entry into the IBM mainframe system. The screens displayed in this exercise are intended as a reference to assist you as you progress through the remaining lab exercises. These action items are to be performed on the actual live system.

Objectives

- Access the Skytap environment
- Access the system image
- Log on to TSO
- Access the ISPF Primary Option Menu
- Navigate through the TSO/ISPF screens
- Logoff TSO

References

SC34-4823	Interactive System Productivity Facility (ISPF) User's Guide

Exercise instructions

Preface

Note

On some keyboards, the Enter key for z/OS is the right CTRL key. Take care when entering your password. If you enter the password incorrectly four times, your user ID will be revoked. Contact the Help Desk for support.

Section 1: Gathering information and accessing the lab image

In these labs, you will logon to TSO in a z/OS system to do the exercises.

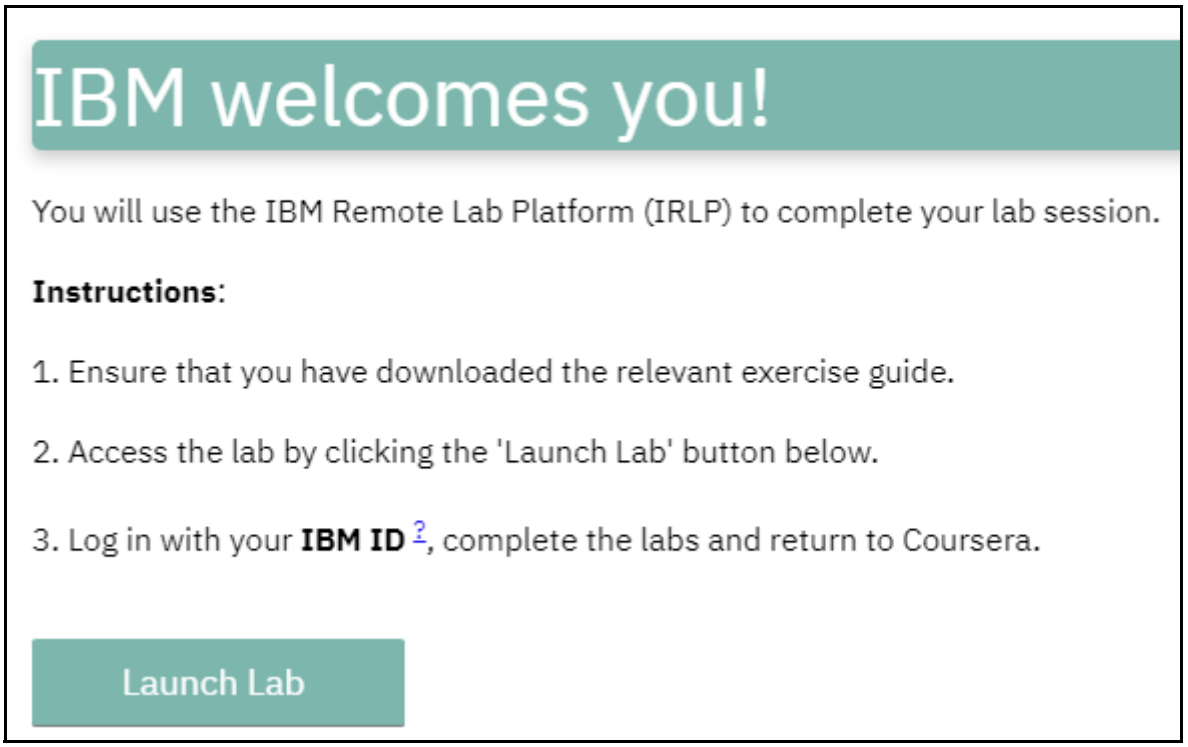
You don’t access the z/OS system directly, but from a Windows virtual machine.

In this part of the lab, you’ll learn how to login to the Windows virtual machine.

Note

The screenshots below are from a generic course and will not match exactly what you see.

__ 1. Now that you are ready to perform the lab exercises, select the **Launch Lab** link to start:



The first time you click on **Enter**, the system creates the Windows virtual machine that you use to logon to z/OS.

__ 2. **Wait until the Windows virtual machine is up and running.** You should see this (the virtual machine showing “busy”) for a few minutes (it will be faster the next time, once the virtual machine has been created):

__ 3. **Once the virtual machine is up and running**, you'll see this at the top left corner of the screen:

This has your **course code** (remember the above is a generic screenshot so it does not show *this* course's code).

If you need to report a problem to the Help Desk, you will be asked to provide the **Course Code** and **Reference ID**.

The most important part is the third line. The **Course Lab Kit** is a document that contains detailed information about the lab environment and your **Windows and TSO credentials**.

Click on "Click here for Course Lab Kit..." to view the Course Lab Kit (described below).

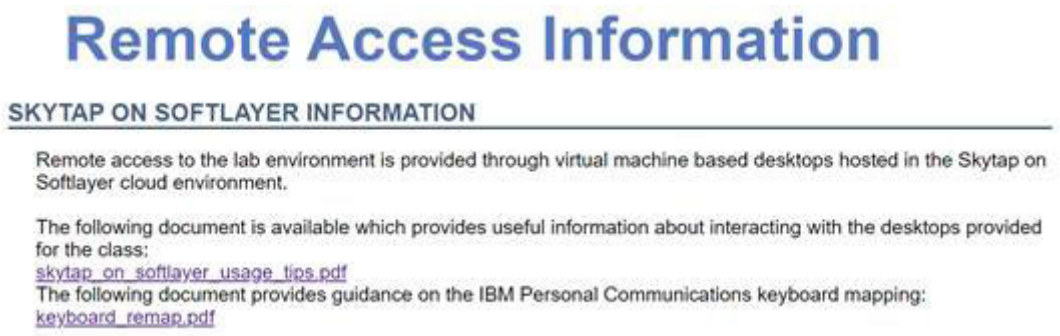
Note

The first time you access the Course Lab Kit, you may see a message saying "The setup... is currently underway. This process may take up to 10 minutes...".

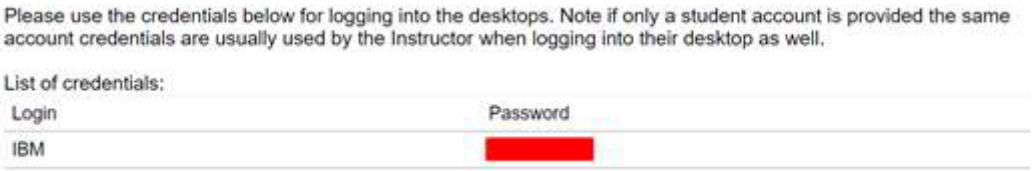
Stay on the page. Once the setup is complete, the page will refresh and you'll see the Course Lab Kit.

__ 4. In this Guide, we provide high-level instructions to access the Lab environment. For detailed information, download **"Help how to login to your system"**, **at the top of the Course Lab Kit**:

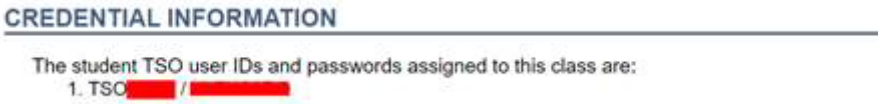
__ 5. Scrolling down you will find two more documents that you may find useful: “Skytap on SoftLayer Virtual Machine Usage Tips” and “Keyboard remapping”:



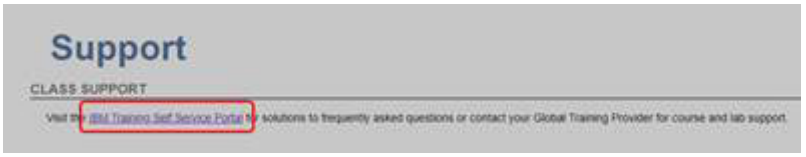
__ 6. **The next bit is important**, as you need it to login to the Windows virtual machine. **Make a note of the userid and password shown**:



__ 7. Scroll down to CREDENTIAL INFORMATION and **make a note of your TSO userid and password**:



__ 8. At the bottom of the page is a link to the Help Desk, in case you need to report a problem:



To report a problem, click on the link, then “Get Help”.

__ 9. Record your information here for reference:

PC Image Login: IBM _____

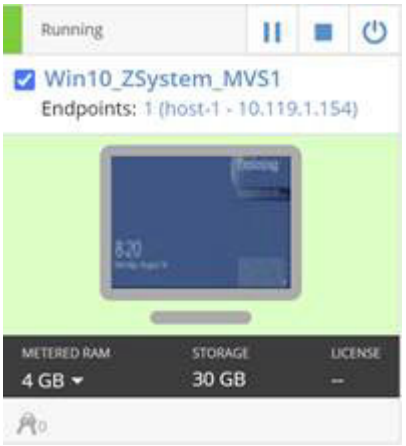
PC Image Password: _____

System name: MVS1

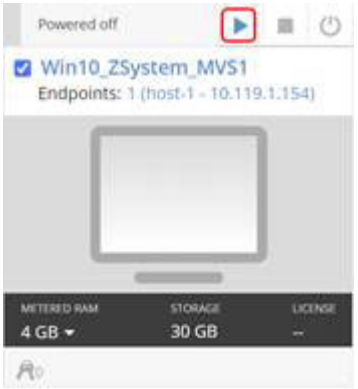
TSO user ID: _____

TSO password: _____

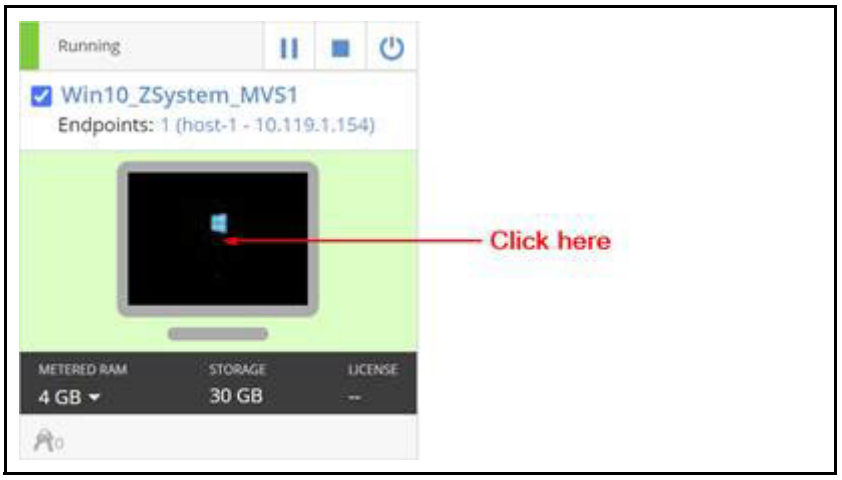
__ 10. Back to the virtual machine. When the virtual machine is ready, the display background becomes green, and the indicator (top left) reads “Running”.



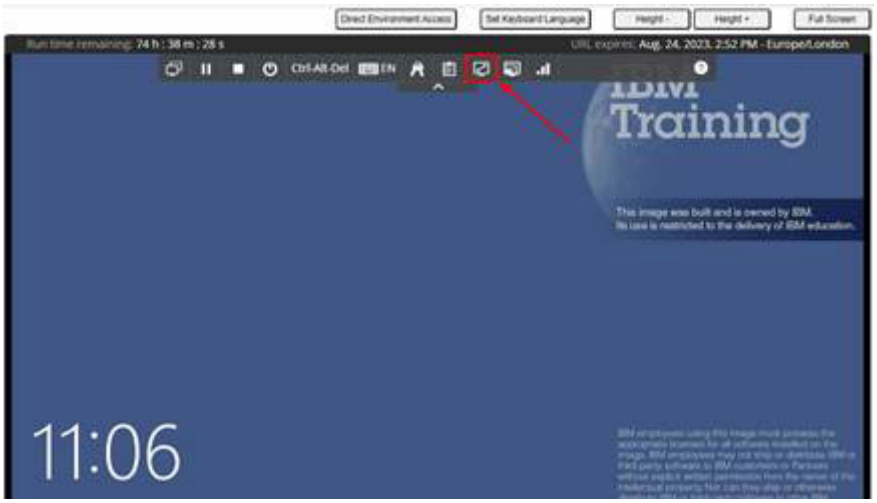
Next time you connect, the virtual machine may not be running (it shuts down automatically after a while if idle). If that happens, click on the **play** button, and wait until it’s running:



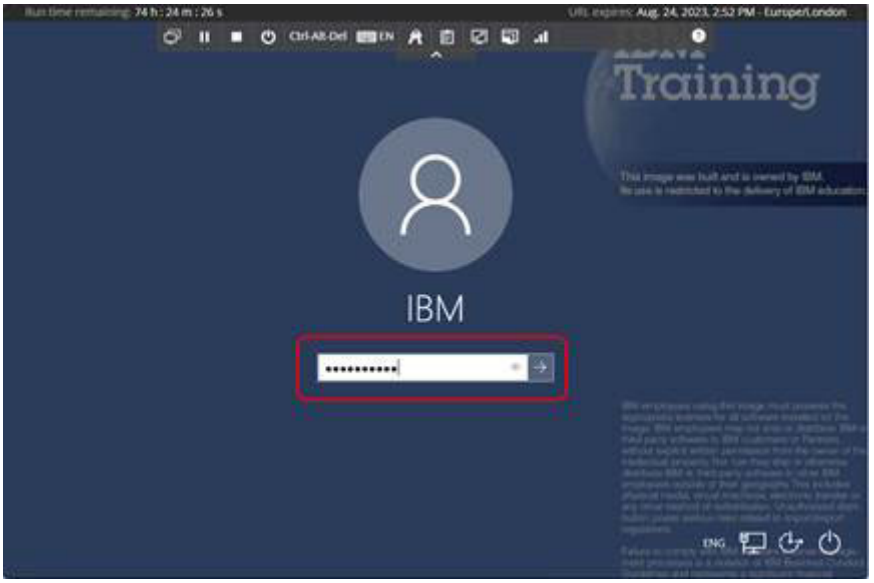
__ 11. Click inside the virtual machine icon to open the Windows desktop:



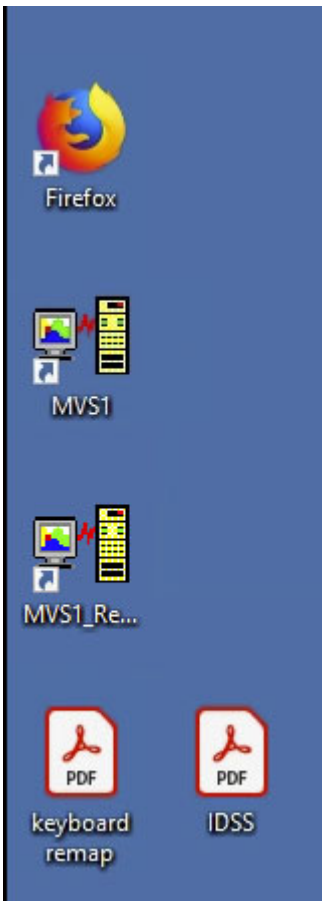
__ 12. You should see the Windows desktop. Depending on your screen resolution, you may not see the whole desktop area. Click on the highlighted button (it shows “Fit to window” if you hover the mouse over it) to fit the Windows desktop to your display:



__ 13. Click anywhere on the Windows desktop to bring up the login screen. Use the Windows credentials you saved earlier.



__ 14. After logging in to Windows, you should see:

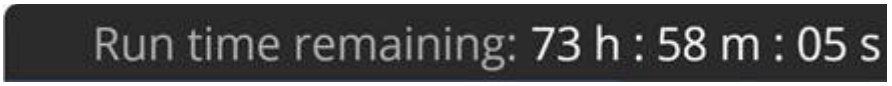


__ 15. If you prefer to work on a full screen, click on the **Full Screen** button at the top. **To exit full screen, use the Escape key**.

You can increase the display height by clicking on **Height +** 2-3 times until the desktop fills the screen (you must click on Height at least twice, as the first click does nothing):

A note about lab availability

At the top of the virtual machine screen, you will see this on the left...



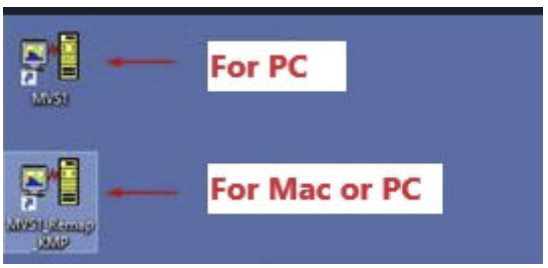
...and this on the right:

Your virtual machine will be available until the date shown in “URL expires”, or after the hours of operation shown under “Run time remaining”, whichever comes first.

Accessing the z/OS system

To access the lab z/OS system from the Windows virtual machine you’ve just logged in to, we use the Personal Communications (PCOMM) terminal emulator.

You will see two PCOMM icons in the desktop:



If you are using a Windows/Linux PC or laptop, you can use either icon, depending on your preference for the location of the Enter key in the keyboard.

If you are using a Mac, you **must** use the other icon (labeled "**MVS1_Remap_KMP**").

Where is the ENTER key in a 3270 terminal?

- Using the top icon (labeled "**MVS1**"), the 3270 ENTER key is the **right CONTROL key**.
  This places the ENTER key at the same location of the original 3270 keyboard.
  People familiar with the 3270 keyboard will prefer this setting.
- Using the bottom icon (labeled "**MVS1_Remap_KMP**"), the 3270 ENTER key is the **RETURN key**.
  This will feel more natural to those who haven't used 3270 keyboards.
  Note this is the only option for Mac users, as there is no right CONTROL key in the Mac keyboard.

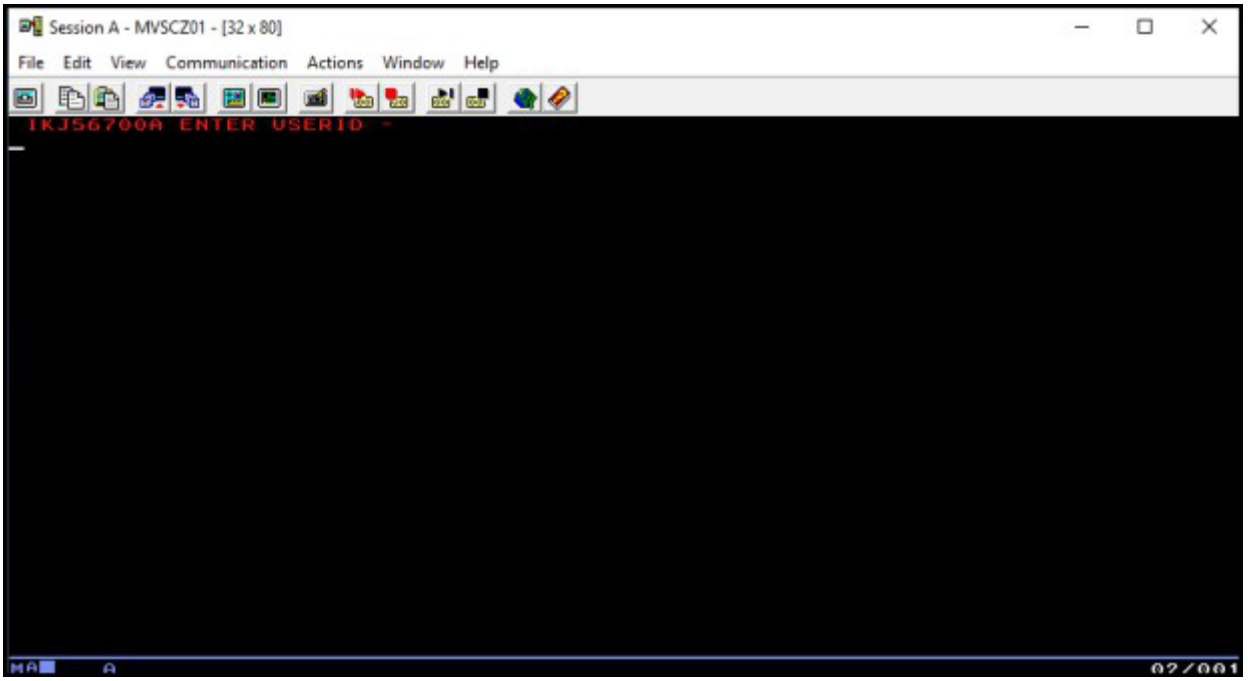
__ 16. **Double-click** on **MVS1** (PC) or **MVS1_Remap_KMP** (PC or Mac), enter the assigned **TSO user ID** and press the **Enter Key.**

This will open the terminal emulator. Note that it takes a few seconds for the app to load and start. When you double-click, it will seem that nothing happens; you just need to wait.

__ 17. The TSO logon prompt appears. **Enter the TSO Userid** you recorded in Step 9, above, and **press Enter**.

Note

In TSO, **neither Userid nor password are case-sensitive**.
If the Lab Toolkit says that your TSO Userid is, for example, TSOAA55, you can enter tsoaa55.
Same for password: XXAA1122 is the same as xxaa1122.



Section 2: The logon screen

The following is a short description of each of the fields as they appear on the logon panel:

• User ID: A TSO user ID is 1 to 8 characters in length. It starts with an alphabetic or national character (A-Z, #, ¢, @). All following characters can be alphanumeric or national characters (A-Z, 0-9, #, ¢, @).

• Password: The password is 1 to 8 alphanumeric or national characters (A-Z, 0-9, #, ¢, @). Any combination of these characters can be used in the password. Certain installation-specific rules might apply. The password is not visible during logon.

DO NOT change your password.

• Procedure: A logon procedure name is required to log on to TSO. If you have more than one logon procedure, the value LOGON ensures that the procedure name entered is valid for the account number that you might have also entered. The procedure name is up to 8 characters in length. The first character has to be alphabetic. All following characters can be alphanumeric or national (A-Z, 0-9, #, ¢, @).

• Acct Nmbr: If you have been provided an account number, you might be required to enter it in order to log on to TSO. If the account number is required and you omit it, you are prompted to enter it. The account number has a maximum of 40 characters.

• Size: This entry allows you to specify a region size for your TSO session. A default region size is used if none is specified.

• Perform: This field is reserved for your performance group. The value has to be an integer from 1 to 255. Your installation might have authorized performance group values for you. If not, entering a value has no effect on your TSO session.

• Command: You can enter a TSO command at logon time. This is processed after any command the TSO/E administrator has entered in the parm field on the EXEC statement of the logon procedure. TSO/E does not execute the command you enter in the COMMAND field if the command specified in the parm field of the logon procedure fails.

• New Password: If your user ID is defined to RACF, you might want to change your password, or you might be required to do so. To change your password, enter your current password in the PASSWORD field, and then enter your new password in this field. The same password rules as for the old password apply. When you enter a new password in this field, you are prompted to verify the password. Only then, the password is changed.

DO NOT change the password.

• Group Ident: If your user ID is defined to RACF, you can enter a RACF group ID. Your RACF group ID can be up to 8 characters in length. The first character must be alphabetic or national (A-Z, #, ¢ or @). The remaining characters, if any, can also contain numerics (0-9).

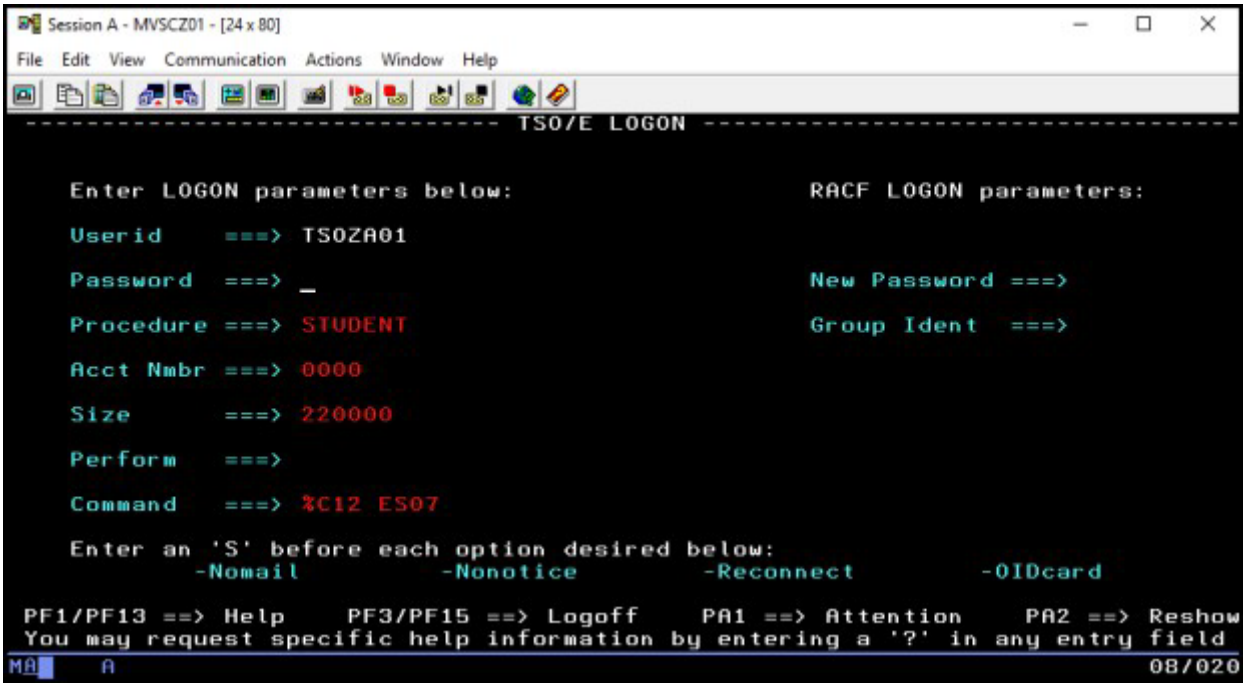
• -Nomail By entering S before this option, you choose not to display messages intended specifically for you during logon processing. If you do not select this option, all messages intended for you are displayed on your terminal during logon.

• -Nonotice: By entering S before this option, you elect not to receive messages intended for all TSO users during logon processing. If you do not select this option, all messages intended for all TSO users are displayed on your terminal during logon.

• -Reconnect: By entering S before this option, you indicate that you want to reconnect your logon session if the session was disconnected. If the session was not disconnected and your user ID does not currently have a session established, logon processing occurs.

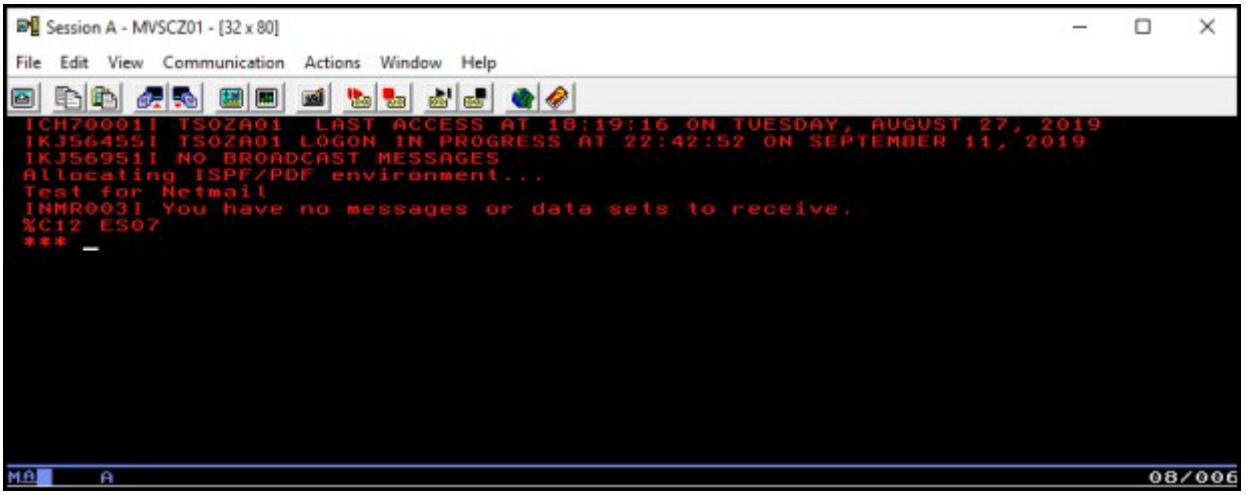
• -OIDcard: If your user ID is defined to RACF and you want to enter data through the Operator Identification Card (OIDCARD), you are prompted to do so during the logon process. To enter data, slide your OIDCARD through your OIDCARD reader attached to your terminal.

__ 18. Using the information you recorded in step 9, enter the assigned **TSO password** and press the **Enter Key.** *Remember, the password is not case sensitive.*



Once you have successfully logged on, the following screen will appear.

Note, at the bottom, the three asterisks followed by the cursor (‘* _’)**:



__ 19. It is important to remember this: **whenever you see three asterisks in TSO, the only thing you can do is press ENTER!**

So, **press ENTER**.

Section 3: ISPF Primary Menu

When you log on, you log on to TSO. TSO presents a command line similar to the terminal/command prompt in Windows or Mac.

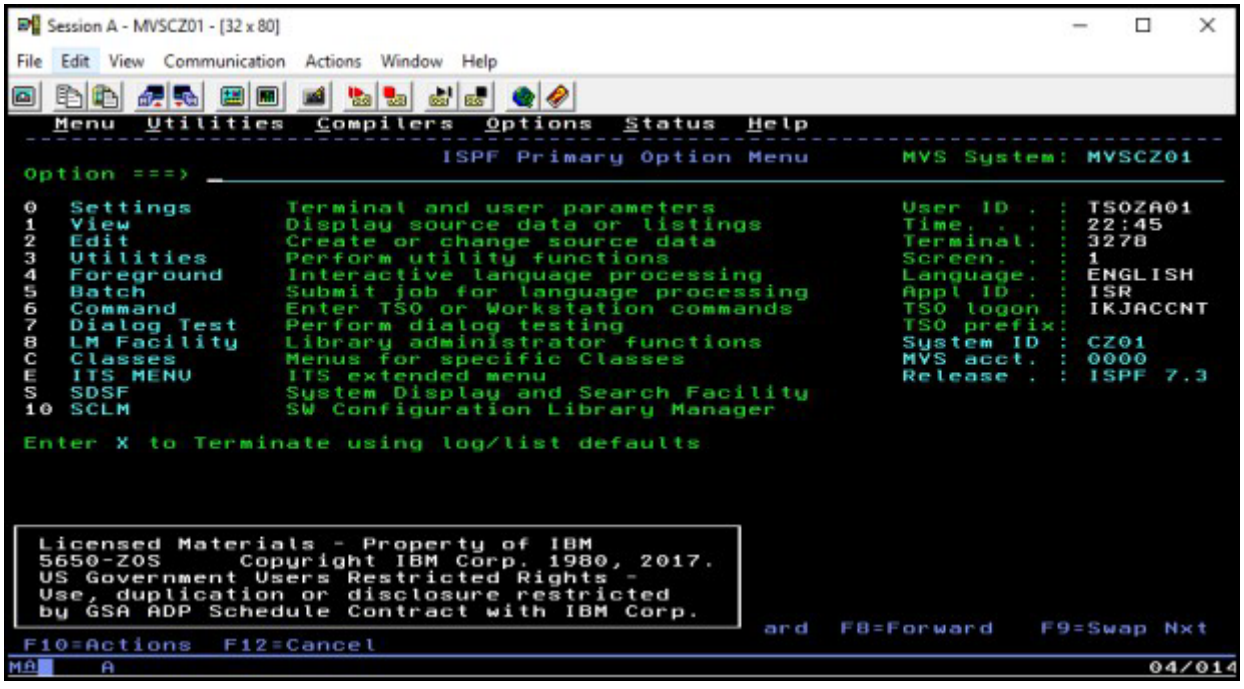
Apart from the userid logon prompt, you never see the TSO command line, because the system automatically starts the menu-based ISPF application. After you press ENTER, you'll see the ISPF main menu.

Note

Recall what Jeff says in the video. We'll mention many acronyms (like "TSO" and "ISPF") without saying what they stand for.
These names are now always used as acronyms. Knowing what's behind TSO or ISPF doesn't help understanding them better.
OK, since you ask.
TSO: Time Sharing Option. This made sense in 1978 but no so much today.

Same for ISPF: Interactive System Productivity Facility, or ISPF/PDF (PDF: Program Development Facility).

This is the ISPF main menu:



Note the "Option ===>" field. We will refer to it as **the command line**.

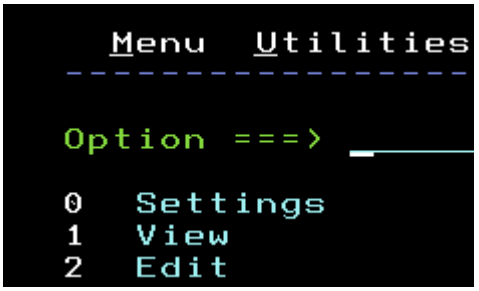
__ 20. **Press the Enter key** to remove the Licensed Material copyright information from the screen.

PCOMM terminal emulator tips

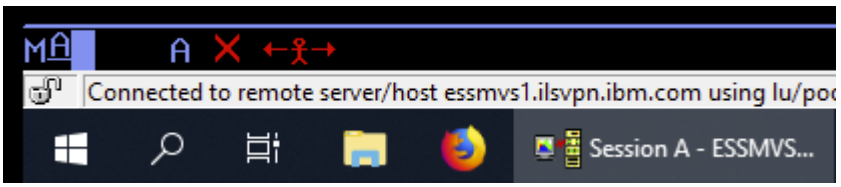
Before we proceed, a few tips about how to work with the PCOMM 3270 terminal emulator.

The RESET key

3270 screens have **protected** and **unprotected fields**. You can type in unprotected fields (also called **input fields**), but not in protected fields.
When the ISPF main menu appears, the cursor will be at the main input field, next to “Option”, where you can, well, enter your option.
If you press the Tab key, you will see the cursor moving to the next input field. Keep pressing Tab, and you’ll be back to the Option field.



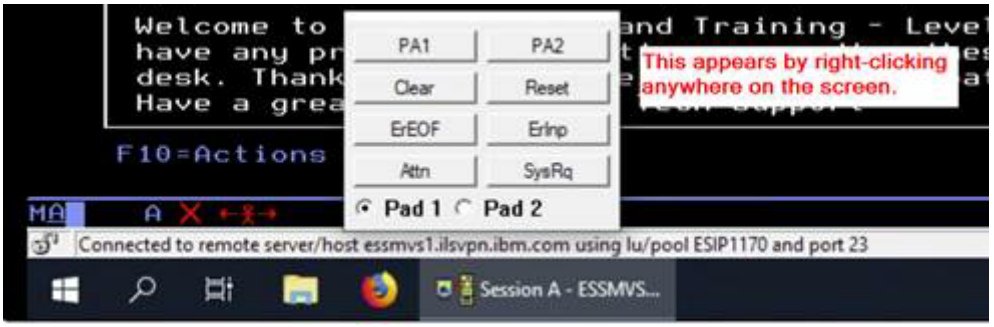
If you type on a protected field by accident, the screen locks and you won’t be able to do anything until you unlock it. A locked screen has this symbol (in red) at the bottom left:



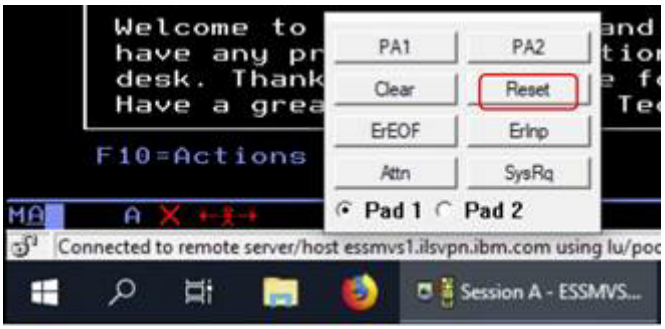
To unlock the screen, you must press the 3270 **RESET key**. In both PC and Mac, the RESET key is the **left CONTROL key**.

The Pop-Up Keypad

Another way of entering special 3270 key functions, like RESET, is with the Pop-Up Keypad. **Right-click anywhere on the 3270 screen** and the Pop-Up Keypad will appear:



You can the click on the 3270 key you want. For example, to enter RESET:



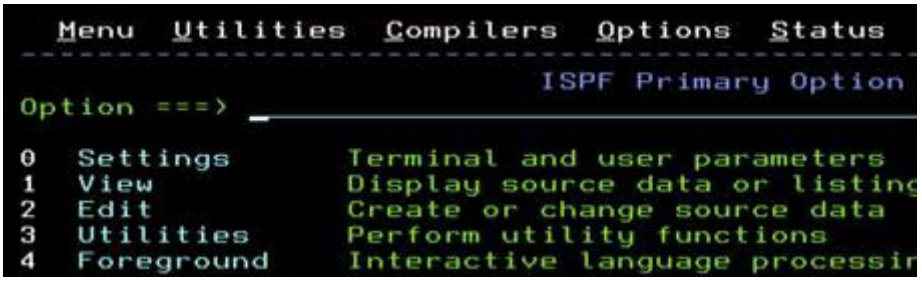
The PA2 Key

When working on a 3270 screen, you are connected to a z/OS system.

Nothing changes on the system until you press ENTER. If you started typing something and realize it was a mistake before you pressed ENTER, you can undo what you typed by pressing the PA2 key.

Right-click to bring up the Pop-Up Keypad and press **PA2**:

After pressing PA2, the typed text is cleared:



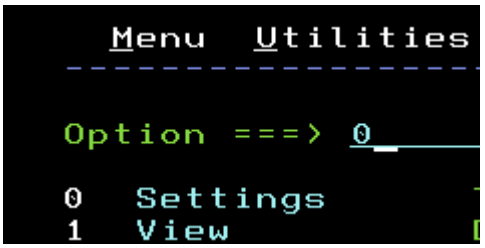
The Function (F, or PF) Keys

In this labs, you'll frequently see the instruction "press the F1 key" or "press the F3 key".

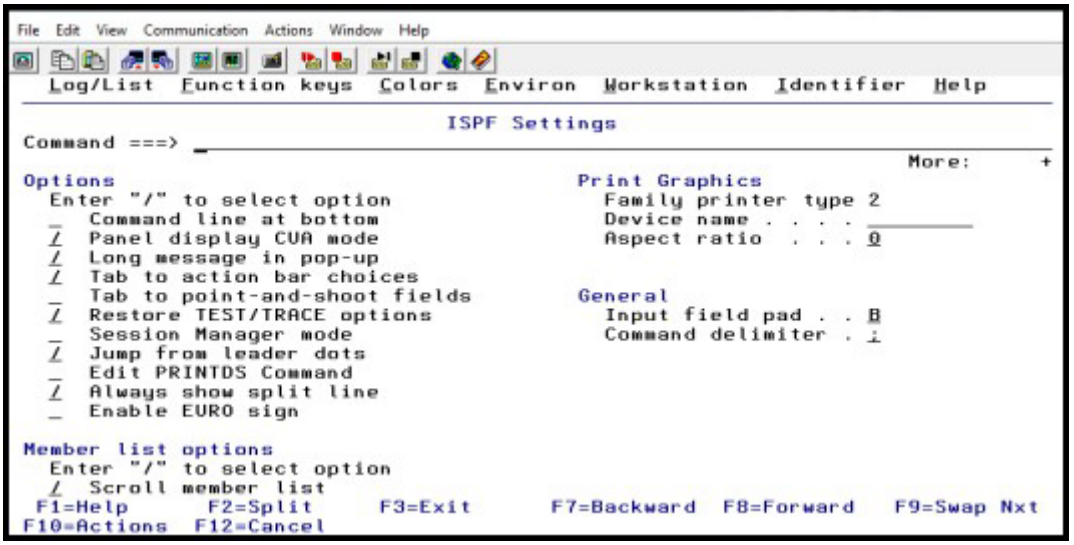
Depending on your laptop setting (this is not something we can control), you may have to use the Fn key plus the Function key combined (for example, to "press F1" you may need to press Fn + F1 together).

Section 4: ISPF Settings

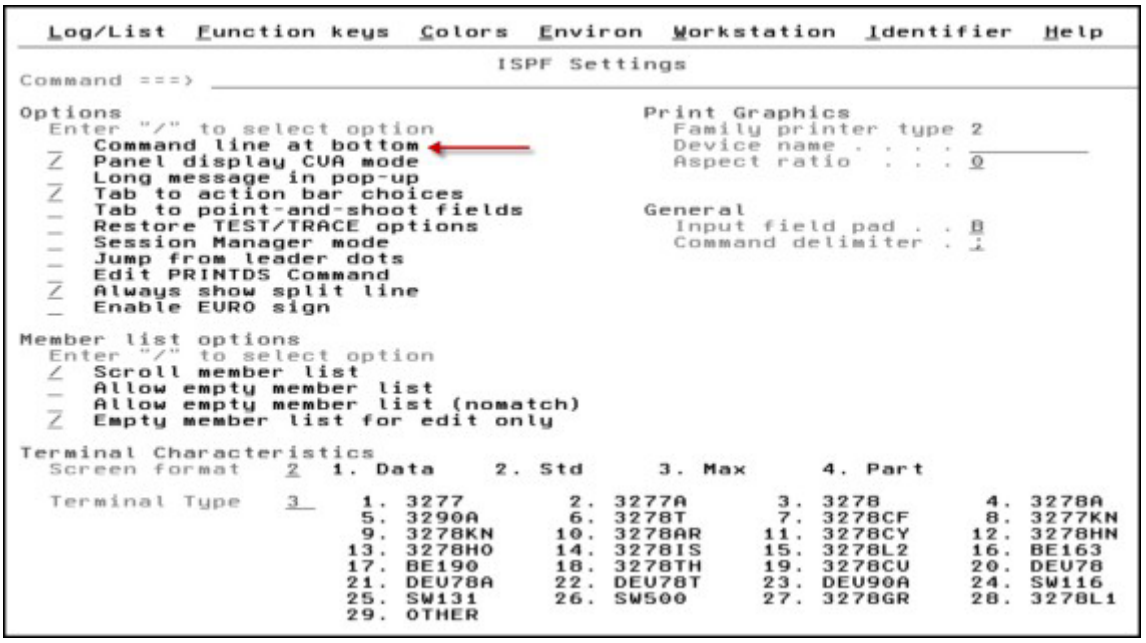
__ 21. Your first task is to alter the settings for your ISPF/PDF session.
Type '0' (zero, not the letter O) in the Option field, then **press Enter**, to open the ISPF Setting panel:



The ISPF Setting panel will appear:



__ 22. Use this panel to familiarize yourself with the ISPF settings.



__ 23. Place a **forward slash** in front of **Command line at bottom** and press the **Enter key.**

Important

To get the cursor to the Command line at bottom field, so you can type a forward slash, you can use

- The **Tab key** to tab forward to the next field.
- **SHIFT + Tab** to tab backwards to the previous field.
- The hard way, using the **cursor arrow keys (left, right, up, down)** to move the cursor one character at a time.
- **The mouse**: move the pointer to the field you want and click. This may need adjusting with arrow and or Tab keys.
- A combination of the above.

The command line now displays at the bottom of the screen.

__ 24. Remove the **forward slash** front the front of **Command line at bottom** and press the **Enter key**.
The command line now displays at the top of the screen.

__ 25. Now we'll see how long messages appear in a pop-up window.

Enter an invalid selection (for example, "xxx") on the Command line ===>**xxx** and **press Enter**.

A *short message* reading **Invalid command** should now appear in the upper right corner of your screen.

__ 26. Now press **F1** to display the corresponding *long message*.
"xxx is undefined" should now appear in a pop-up window.
Press **F1** again for additional help.
Press **F3** to return to ISPF Settings panel.

Information

A note about the F3 key, as this is the first time we use it.

In almost all ISPF panels, **F3** is the **END** key: when you press it, you leave the panel you're in and return to the panel you came from.

If you press F3 repeatedly, you will eventually be back to the ISPF Main Menu.

__ 27. To continue, clear the command line and press **Enter** again.

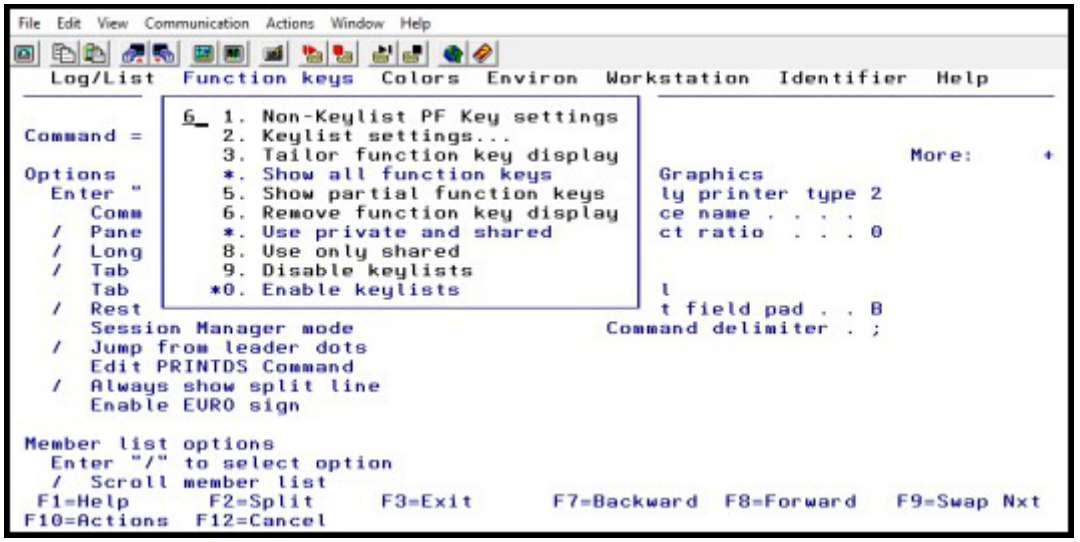
__ 28. Ensure that the option **Tab to Option bar choices** is selected in the ISPF settings panel.

__ 29. Optional: explore what the other options do (you may not understand them all as this is the first time you see ISPF.
Place the cursor under an option and press **F1** to display its associated help.
Press **F3** to close the help and return to the standard panel.

Section 5: ISPF Settings: Action bar choices

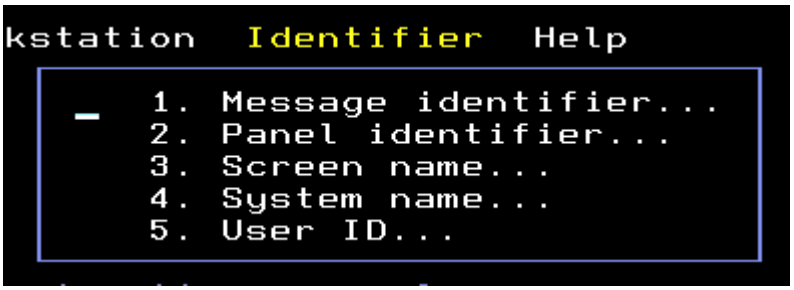
__ 30. Use the Tab key to select **Function keys** on the action bar, which is located at the top of the panel. When the cursor is under Function keys, **press Enter**. The Function keys options appear (see below)

__ 31. Hide the function key display (type **6** and **press Enter**). Now reset it (type **4** and **press Enter**), so that the function key settings are once again displayed at the bottom of the screen.

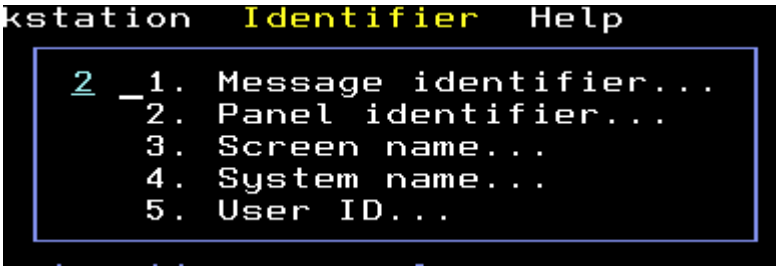


__ 32. Select Identifier from the action bar and activate the panel identifier display:

Place the cursor under Identifier and **press Enter**. This opens an options dialog.



Type **2** (Panel identifier...) and **press Enter.**



The panel identifier setting opens.

Type a slash (**/**) next to Display panel identifier and **press Enter**.

Check your panel for the panel name in the upper left corner. (Most start with “ISP”.)

Panels can be modified, and this tells us the panelid (member name) of the panel.

Reset the panel identification display to off (**repeat the steps above, this time clearing the slash, "/", next to Display panel identifier**).

Optional, if you feel like exploring a bit more: you can also display the system name and your user ID on every panel by activating the corresponding option.

__ 33. Press **F3** to return to the main ISPF menu.

Section 6: View a data set

__ 34. To view the contents of a data set (recall that, in z/OS, files are called data sets):

Type **1** (View) in the ISPF main menu and **press Enter**.

There are two ways to view a data set from the View Entry Panel.

__ 35. In the first option, the data set can be entered in the fields under ISPF Library:

Project: High level qualifier of the data set. **In this case, it is your TSO user ID**.

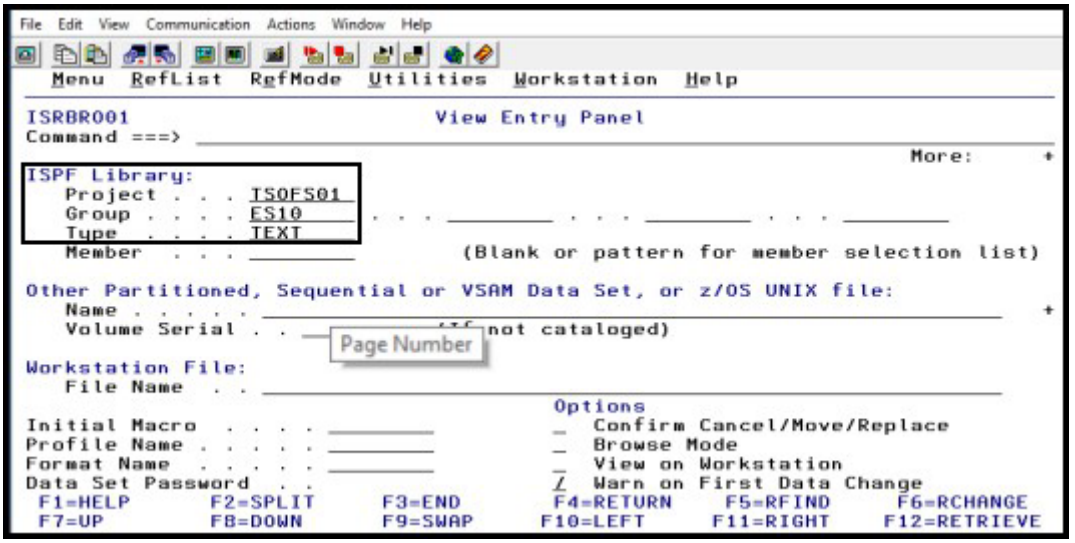
This should contain your user ID already (so no need to change it). If it doesn't, **type your userid**.

Group: Qualifier of the data set. In this case, it is **ES10**.

This should already be **ES10**. If it isn't, **type ES10**.

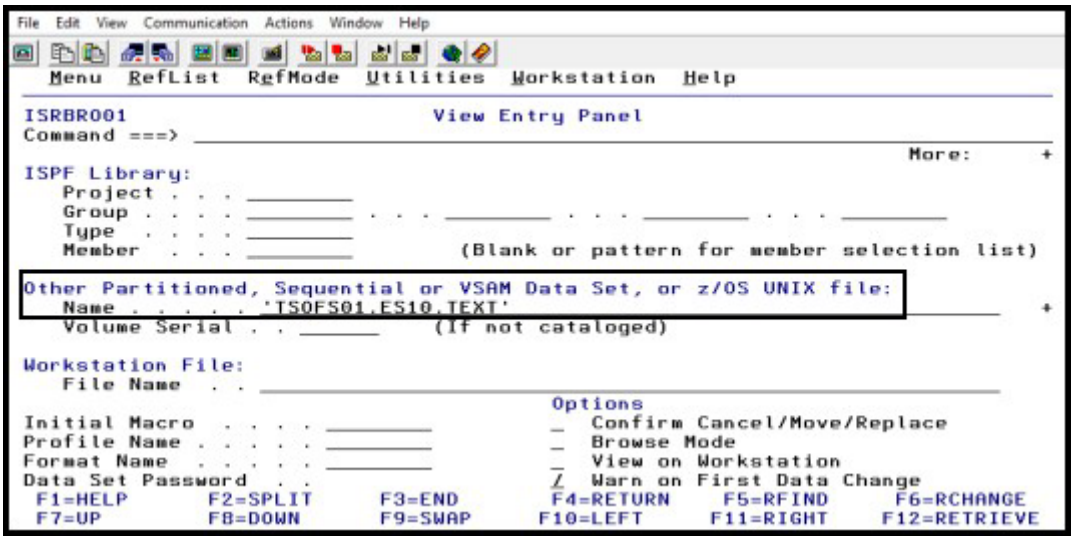
Type: Low level qualifier of the data set. In this case, it is the word TEXT.

If this isn't **TEXT**, **type TEXT**.



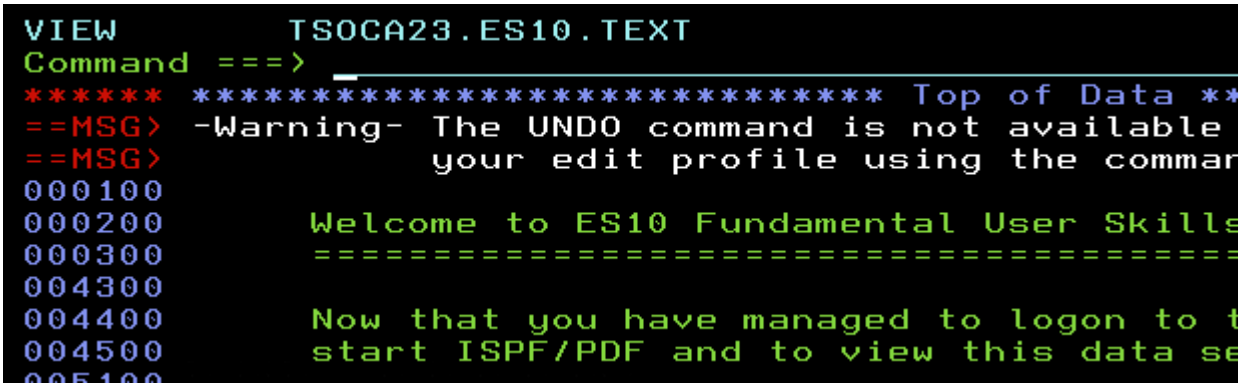
The second way to view a data set from the View Entry Panel is in the Other Partitioned, Sequential or VSAM Data Set, or z/OS UNIX file section.

The data set is entered in the Name field, with apostrophes (**'your userid.ES10.TEXT'**):

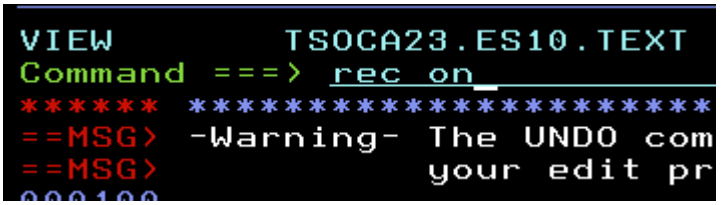


__ 36. After you entered the data set name (using either method, above), **press Enter.**

The data set (file) contents will appear (showing a partial screenshot to fit this page):



__ 37. Note the "-Warning- The UNDO command..." message. It is rather annoying and takes valuable screen space (2 lines out of 32). To remove it, do what the message suggests: enter "**RECOVERY ON**" or its abbreviations, "**REC ON**":



Press Enter. The message disappears and will not appear again for this data set. This also enabled the UNDO command, which could be useful to, well, undo mistakes when editing.

Section 7: Exit ISPF

For the moment, our work with ISPF/PDF is done. We now want to end our ISPF/PDF session and log off TSO.

__ 38. To leave ISPF:

If you are not on the main menu (maybe you're still on View data set or ISPF Settings), **go back by pressing F3 (End) until you see the main menu.**

Enter an **X** on the main menu's command line.

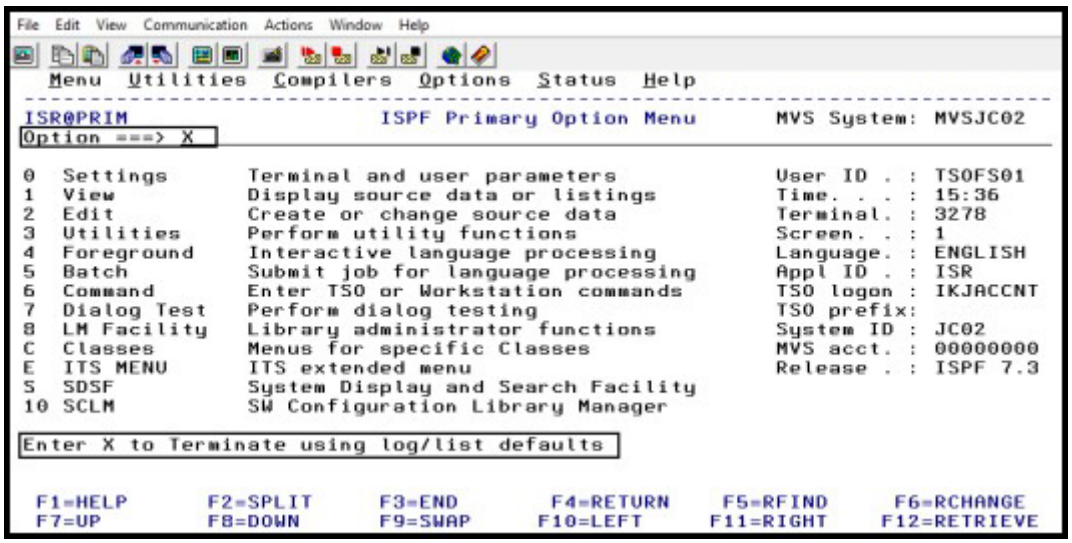
You can also press the **F3 Key**, but **X** is easier, as F3 opens the Log Data Set Disposition

dialog (details next), which isn't used now but remains for historical reasons.

Hint

If you are not on the main menu, you can go back to the main menu by pressing F3 until you get there. and then enter **x** (x: exit).

A quicker way of exiting ISPF is to enter **=x** *from any ISPF panel.*



You now have ended the ISPF session and returned to the TSO command line mode. Your TSO session is still running.

Section 8: Log Data Set Disposition

The following information in this section is only for information. Unless log data is generated, you will not see the Specify Data Set Disposition screen.

ISPF/PDF maintains two data sets for you during your terminal session:

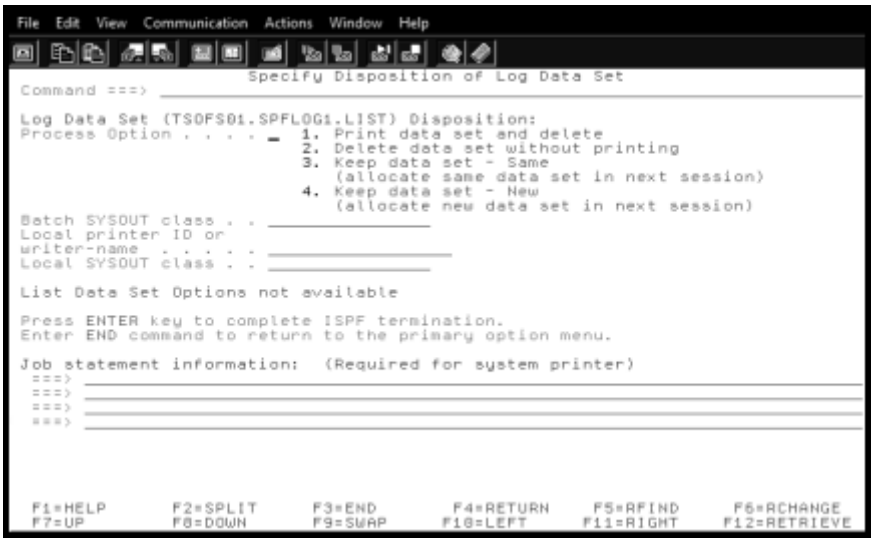
A LOG data set that keeps a record of your transactions while using ISPF/PDF.

A LIST data set that holds information you want to send to the system printer.

The LOG and LIST commands allow you to process the log and list data sets at any time during an ISPF session. The log and list data sets must have been allocated. You control the data set

processing by specifying on the LOG or LIST command one of the three keyword options: PRINT, DELETE, or KEEP.

ISPF maintains a log of significant user activities. This information can be useful, for example, when diagnosing problems. The log data is stored in a data set named *userid.SPFLOGx.LIST*, where *userid* is your TSO user ID.



At the end of an ISPF session you, as the user, can specify what has to be done with the log data set. Enter the selection of your choice.

Print data set and delete: Prints the data set, then deletes it. You must specify an output class or a local printer ID. If you specify an output class, ISPF submits a background job to print and delete the data set. If you specify a local printer ID, ISPF uses TSO's PRINTDS command to route the data set to the printer and then deletes the data set.

Delete data set without printing: Just deletes the data set.

Keep data set - Same: This option closes and frees the data set and allocates the same data set in the next session.

Keep data set - New: This option closes and frees the data set but allocates a new data set when starting the next ISPF session.

Delete data set without printing or Keep data set - Same is the usual choice unless you have had problems.

If you do want to print, then the printer class (SYSOUT class) or destination (local printer ID) must be entered.

Additionally, the four lines of Job statement information must be entered if you use the SYSOUT option.

The line List Data Set Options not available indicates there is no list data set to print.

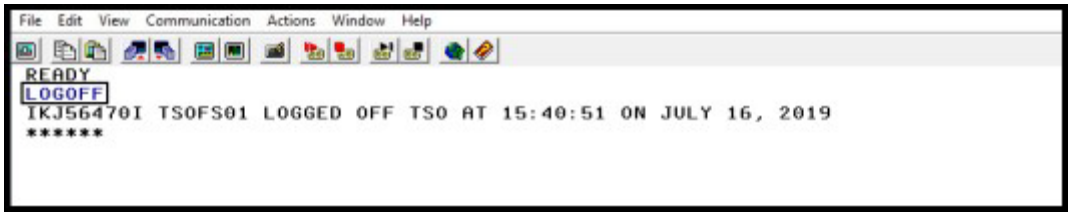
If we performed a print under ISPF, then a similar set of options are provided to dispose of the list data set.

You will see this dialog if you accidentally press **F3** on the ISPF main menu instead of **X** to exit ISPF. **If that is the case, to exit ISPF press Enter.**

You can also press F3 again: you'll be back to the ISPF main menu, where you can **enter x** to exit ISPF.

Section 9: Logoff

__ 39. To terminate your TSO session, enter the TSO command **logoff** on your terminal.



TSO then replies with a message like **IKJ56470I *userid* LOGGED OFF TSO AT ... on ...** to indicate that your TSO session has been terminated.

End of exercise

Exercise 2. Allocate new data sets

Estimated time

00:45

Overview

This exercise begins with how to access additional assistance, if needed. Then, you will have the opportunity to allocate a sequential, partitioned, and partitioned extended data sets. After the allocation process, you will be guided through verifying the successful allocation of each data set.

Information

Just to clarify some z/OS terminology:

- In this lab, when you read **“allocate a new data set”**, it means what other systems call **“create a file”**. It is true that “data sets” are not the same as files, but, for the type of data sets we’ll be working with, it’s OK to think of them as files.
- A **PDS (Partitioned Data Set)** is a file that contains other files called “**members**”. This is similar to a PC folder that contains files (with one difference: a PC folder may contain sub-folders. A PDS can only contain members, that is, files).
- A **PDSE (PDS Extended)** is a newer version of PDS. They are easier to maintain and manage, but it is unlikely that you’ll notice a difference. **You will normally work with PDSEs.**
- A sequential data set, or sequential file, is just that, a file. Members inside a PDS or PDSE are sequential data sets. They are called “sequential” because you read them (or write them) one record at a time, starting from the first record, then the second, and so on, sequentially.

Objectives

- Access additional assistance, as needed.
- Allocate (create) a Sequential Data Set
- Allocate (create) a Partitioned Data Set (PDS)
- Allocate (create) a Partitioned Data Set Extended (PDS/E)
- Verify the successful allocation of the newly created data sets

References

SC34-4823	*Interactive System Productivity Facility (ISPF) User's Guide*
GC28-1758	*MVS JCL User's Guide*
SC26-7410	*z/OS DFSMS Using Data Sets*
SG24-7419	*Implementing REXX Support in SDSF*

Exercise instructions

Preface

- This exercise depends on the successful completion of the previous exercise.

Section 1: Lab exercise assistance

In the previous exercise, you saw that there is a tutorial and general help for the ISPF menu options.

This lab environment is unique in that there is additional assistance available as you progress through the exercises.

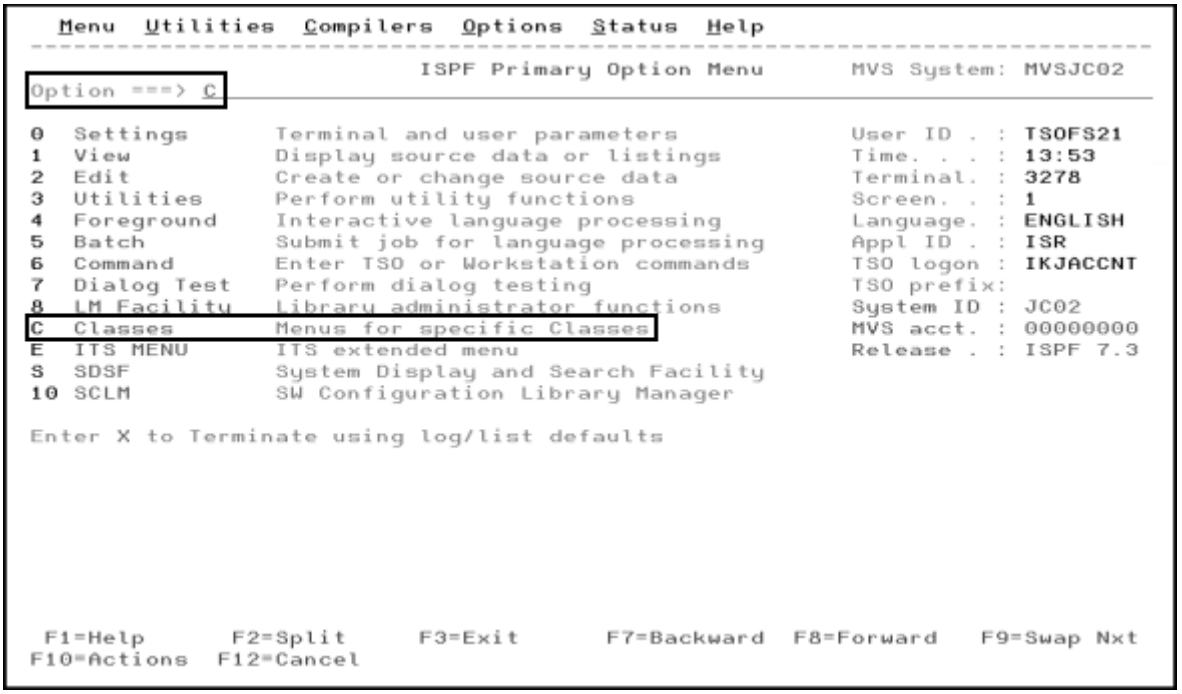
There are two versions of these instructions, which are available:

- One with hints and one without. You can use either version to complete this and all other exercises in this course. You can flip back and forth between the two versions.

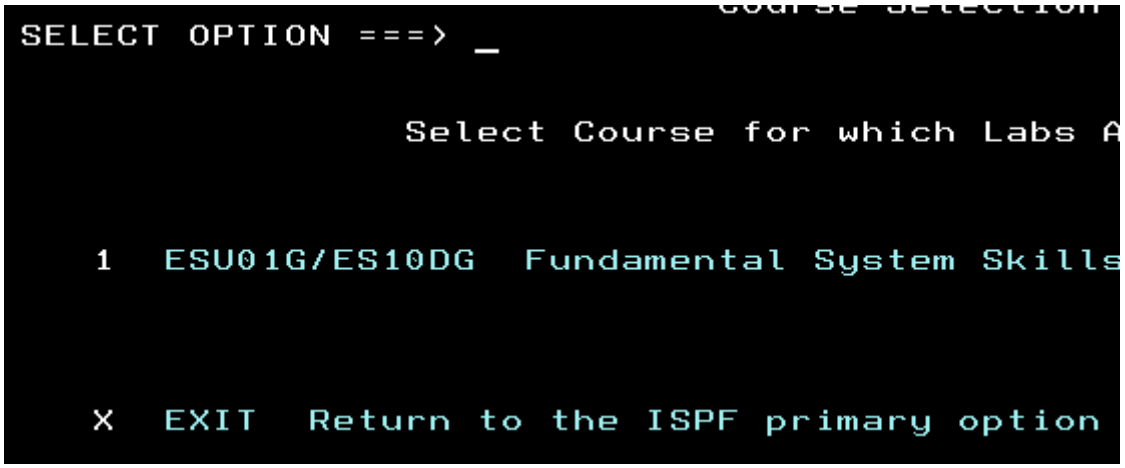
If during any of the lab exercises you require assistance, with allocating data sets, renaming a data set, and so on, this help feature will be available, if you want to utilize it.

__ 1. **Logon to TSO/ISPF** (instructions in the previous exercise).

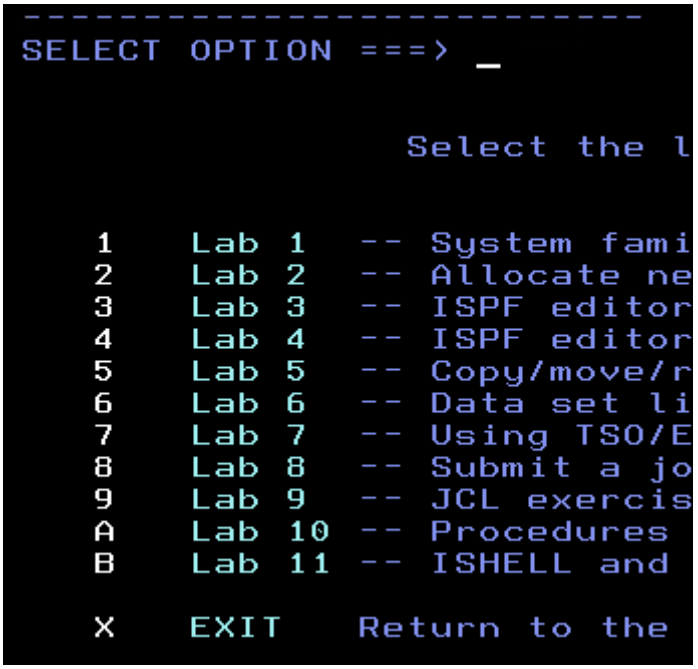
__ 2. From the ISPF Primary Option Menu, **type C** for Classes and **press the Enter key**.



__ 3. On the Course Selection Menu, enter the number **1** to access help menu for most of the labs for course Fundamental System Skills in z/OS.



__ 4. When performing a lab and you require additional assistance, enter the appropriate selection for the specific lab.



Note

This system is shared with another course. This course (Introduction to z/OS Commands and Panels on IBM Z) has 7 exercises (labs 1 to 7). Feel free to explore the others, but remember they are not part of this course.

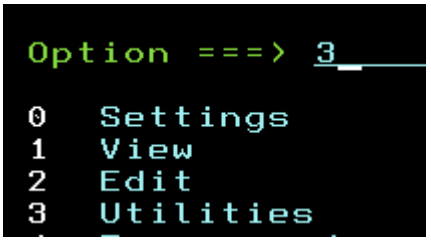
__ 5. Press the **F3 End key** until you are at the ISPF Primary Option Menu.

(Remember you may have to hold down the Fn key while pressing the F3 key.)

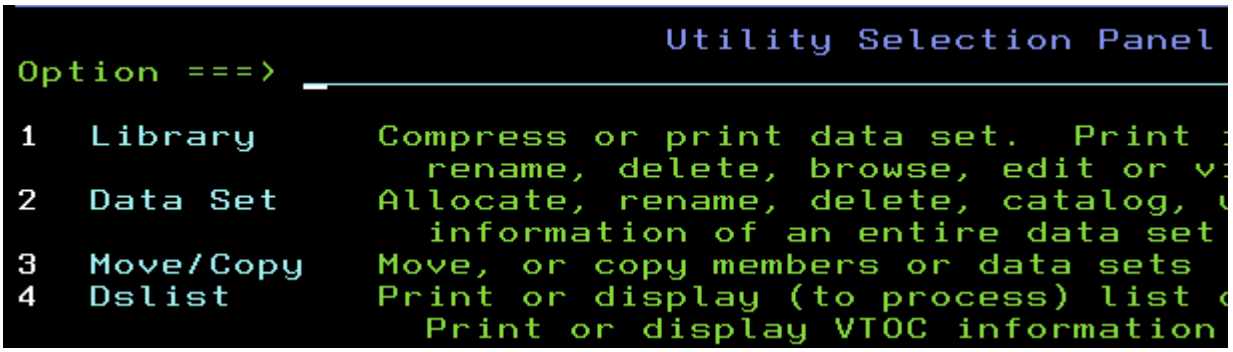
Section 2: Allocate a Physical Sequential data set

__ 6. To allocate (create) a physical sequential data set, you'll use the **Data Set Utility** ISPF panel.

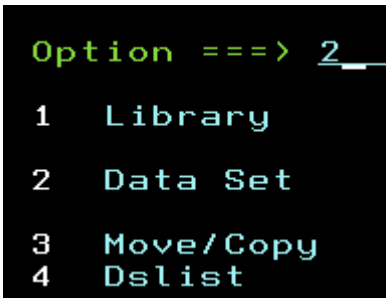
From the **ISPF main menu**, **enter 3** (Utilities):



This will open the **Utility Selection Panel**:



Enter 2 to go to the **Data Set Utility** panel:

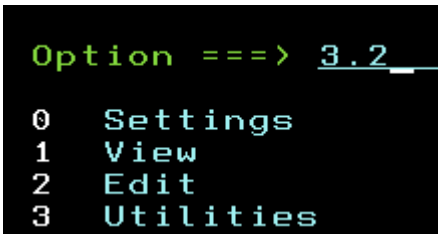


The Data Set Utility panel (see below) will show.

Hint

To open the Data Set Utility panel, you first entered **3** on the main menu, then entered **2**.

You can go directly to the Data Set Utility panel from the main menu by entering **3.2**:

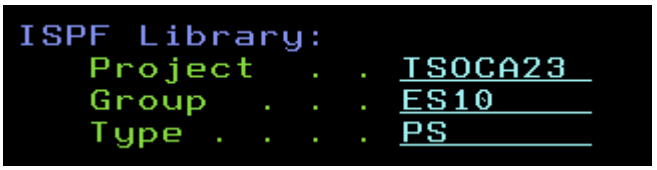


__ 7. **Type a** (allocate) in the option field. **Do not press Enter yet**:

__ 8. You'll allocate a new physical sequential data set named ***userid*.ES10.PS** (where *userid* is the user ID you used to log on to TSO with).

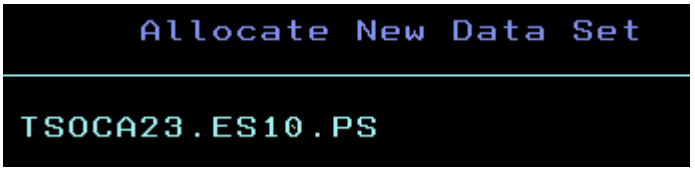
Type in **your userid**, **ES10**, and **PS** in the fields **Project, Group, and Type, respectively**.

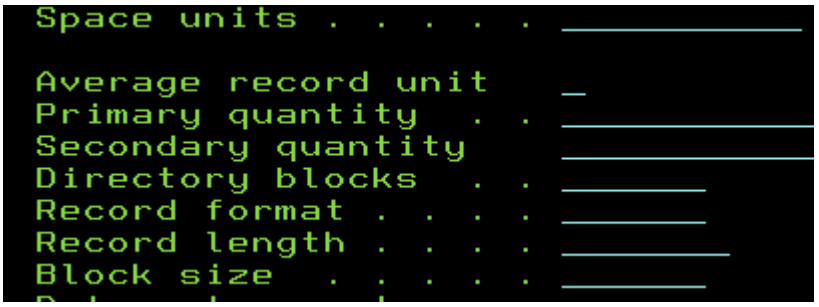
Note "TSOCA23", below, is an example; your TSO userid will be different (except for the one lucky student who gets TSOCA23 as userid!):



You've entered all the necessary data; now press Enter.

This opens the Allocate New Data Set panel (shown as two partial screenshots to fit the page):





__ 9. Give the new data set the following specifications:

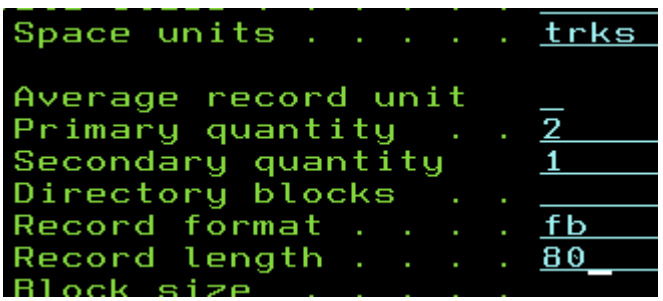
a. We'll tell the system how much space the new data set will take, **in units of disk tracks**
Enter trks in Space units (see screenshot below).

b. **Two tracks primary space**: the data set occupies 2 disk tracks initially.
Enter 2 in Primary quantity.

c. **One track secondary space**: if the data grows and more tracks are needed, the data set grows 1 track at a time.
Enter 1 in Secondary quantity.

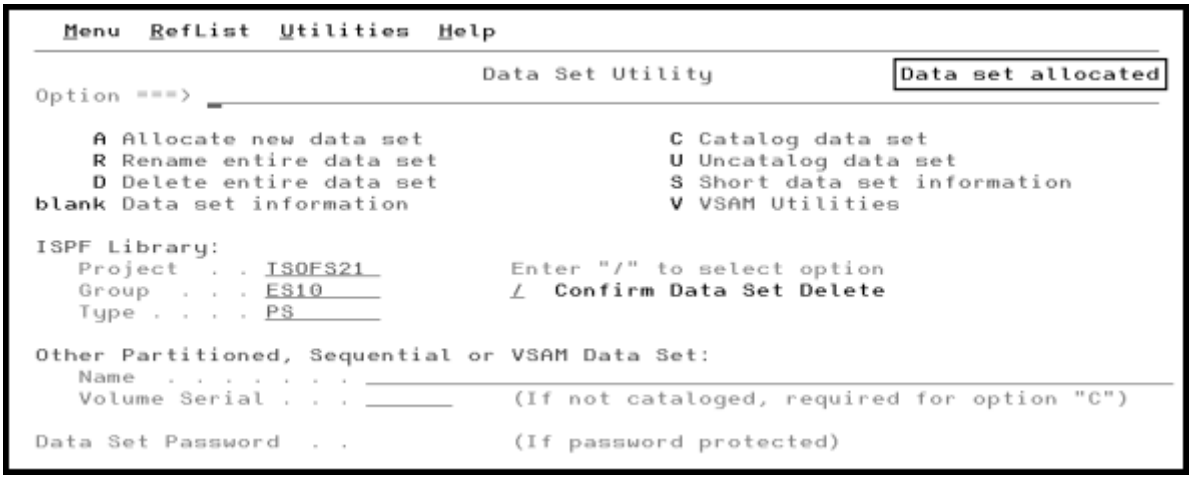
d. **Fixed Blocked length records**. All the record have the same size.
Enter FB in Record format.

e. **Record length 80 bytes**.
Enter 80 in Record length.



__ 10. Do not enter an expiration date; leave expiration date blank for all data sets that you create in this class. All other fields should be blank.

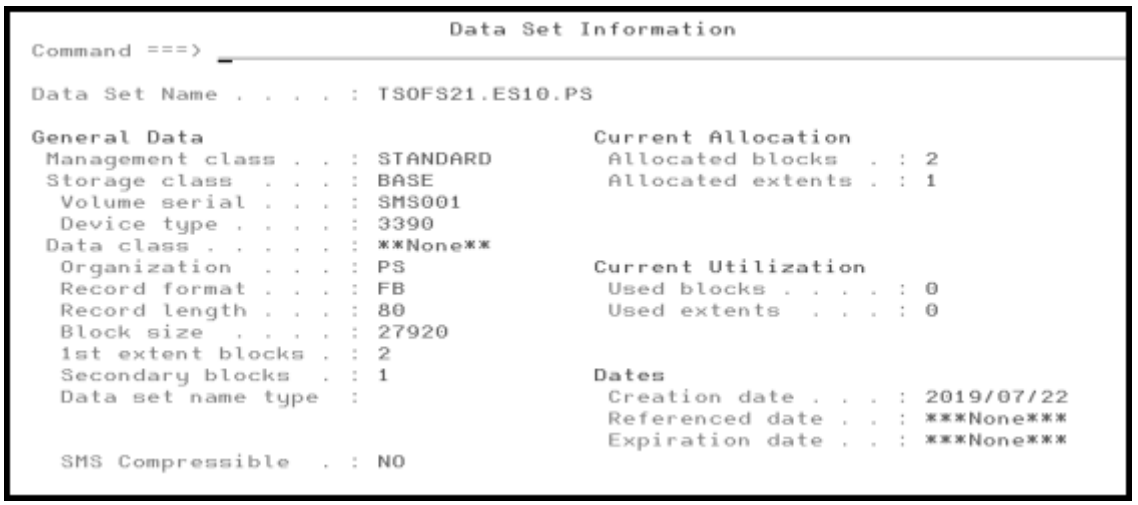
__ 11. Press the **Enter key** to allocate the file.



__ 12. After **Data set allocated** appears in the upper right corner, press the **Enter key** to see the allocation attributes on the Data Set Information screen.

Note some fields could be different, but the values you entered should be on display:

Organization: PS (this means physical sequential).
Record format: FB (fixed record length, written to disk in blocks of many records).
Record length: 80 (each record is 80 bytes in size).
Note Block size: the system chose a block size of 27920. On disk, the file is written in blocks that contain up to 349 80-byte records (27920/80=349). This makes reads and writes faster and saves space on the disk.



If a Block size of zero is specified (which is what you did, by not entering anything under Block size), the system will determine the optimal block size based on the maximum record length (LRECL) and the physical characteristics of the disk. The system-chosen value is approximately half of a physical track.

The following chart is an example of default Block sizes for a Record Format of Fixed Blocked:

Record Format	Record Length (bytes)	Block Size (bytes)
FB	80	27,920
FB	1024	27,648
FB	4096	24,576
FB	8192	24,576

Section 3: Allocate a Partitioned Data Set

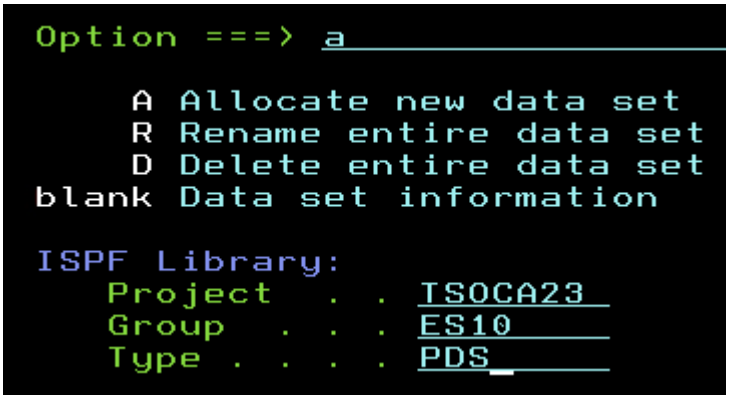
__ 13. You will now allocate another data set, this time a PDS.

To do that: if not already there, go to the **Data Set Utility** panel again. Ways of doing it include (feel free to choose the one you like best):

- From the ISPF main menu, **enter 3** (Utilities)**, then enter 2** (Data Set).
- More direct: from the ISPF main menu, **enter 3.2**.
- Most direct: from *any* ISPF panel, **enter =3.2**.

__ 14. Following the same steps as before, allocate a Partitioned Data Set (PDS) named ***userid*.ES10.PDS** (where *userid* is the user ID you used to log on to TSO with, ***not TSOCA23***).

Enter a (allocate) in the panel's Option field, **enter the data set name** in the fields under ISPF Library, and then **press Enter**:



__ 15. At the **Allocate New Data Set** panel, enter the following specifications for the data set (note the panel is filled with the values from the last data set you allocated):

a. Space units: **BLKS**.

b. **Ten blocks primary space**. Note this time space units is blocks (BLKS), not tracks (TRKS)

c. **Five blocks secondary space**.

d. **Directory size two blocks**. ***This is what makes the data set a PDS***: the fact that it contains a directory (think of it of an index, or catalog, of the members inside the PDS)

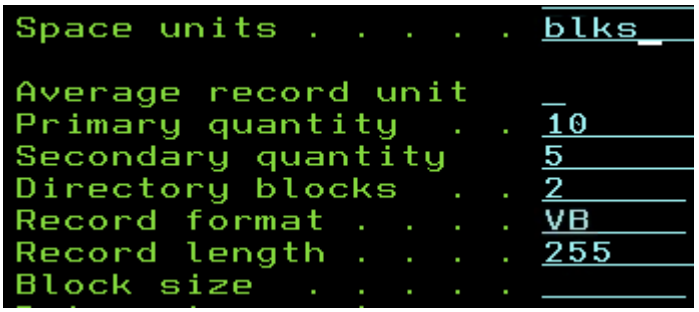
e. **Variable length records**. Individual records inside each member have different sizes, up to the size specified in Record length (255, see below).

f. **Blocked records**. When reading or writing, the system reads or writes many records placed together in a single block.

Enter VB in **Record format** to specify Variable-length, blocked records.

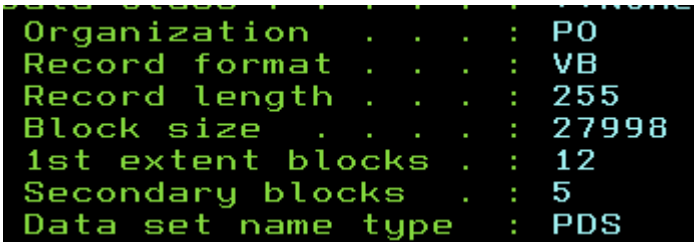
g. **Block size determined by system**. Leave the Block size field blank, or enter 0 (zero).

h. **Record length 255 bytes**.



After typing in all the values, **press Enter**. The data set is allocated.

__ 16. To verify whether the data set has been allocated properly, use the Data Set information panel. **Press Enter** again after allocating the data set. You should see:



Note the Organization is **PO**: *Partitioned Organization* (this means PDS).

1st Extent (12 blocks) is the initial space allocation. It consists of the Primary quantity (10 blocks) and Directory blocks (2).

If a block size is not specified for the creation of a data set, the system attempts to determine the block size.

Using a system-determined block size has the following benefits:

- The program can write to DASD, tape, or SYSOUT without you or the program calculating the optimal block size. DASD track capacity calculations are complicated. Optimal block sizes differ for various models of DASD and tape.
- If the data set is later moved to a different DASD type, such as by DFSMShsm, the system recalculates an appropriate block size and re-blocks the data.

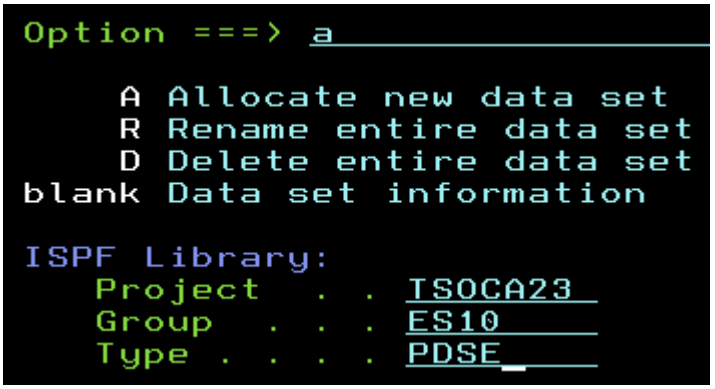
Section 4: Allocate a Partitioned Data Set Extended

__ 17. This time, you will allocate a Partitioned Data Set Extended (**PDSE**) data set.

You know the steps by now. Here's a quick reminder:

At the Options field of the panel you're at, enter **=3.2**. This takes you directly to the Data Set Utility panel.

__ 18. At the Data Set Utility panel, enter **a** in Option and the data set name, ***userid*.ES10.PDSE** (where *userid* is the user ID you used to log on to TSO with, ***not the one in the screenshot***):



After entering the data set name, **press Enter**.

__ 19. At the **Allocate New Data Set** panel, enter to the following specifications (as before, the panel is filled with the values from the last data set you allocated):

a. **Five blocks primary space**.
b. **One block secondary space**.
c. **Directory size: leave blank**. For PDSE, any value you enter here is ignored.
d. **Fixed length** records.
e. **Block records**.
f. **Block size determined by system**.
g. **Record length 80 bytes**.
h. **Data set name type is Library**. ***This (Library) is what makes the data set a PDSE.***

Information

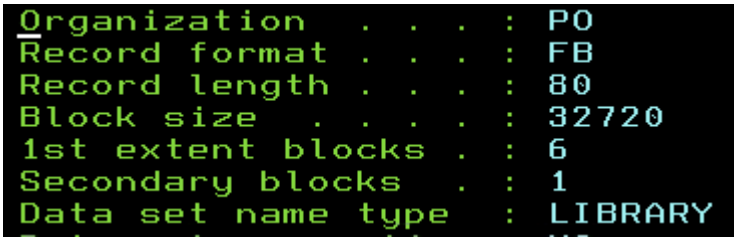
So, given that both contain members, *what is the difference between PDS and PDSE?*

When you create a PDS, you specify disk space in two parts: how big is the data set (in tracks, blocks, cylinders...) and how big is the directory inside the dataset. For example a data set can occupy 50 tracks on disk, and 2 of those are the directory. The problem with PDS was that you had to watch 2 resources that could fill up: if your members are too big, they may need more than 50 tracks, and you would end up with a “no more space for data set” situation. If you create too many members in the PDS, you could have a “no more directory space” error.

When a PDS member is updated, it is written at the end of the PDS, and there remains a “hole” where the old version was. Same when a member is deleted: it is removed from the directory, but still occupies its original space on disk. Over time, the PDS starts to look like a Swiss cheese: full of holes. Eventually, the PDS can run out of space. To prevent that, system administrators must run the **Compress utility** periodically.

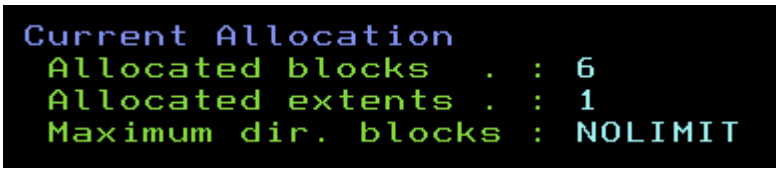
With PDSE, the directory still exists, but it is managed automatically by the system. You never have to worry about running out of directory space, or having to run the Compress utility. As you saw, you don’t even have to specify a directory size when creating a PDSE.

__ 20. To verify whether the data set has been allocated properly, use the Data Set information panel. Press Enter after allocating the data set. You should see this:



The block size chosen by the system is 32720. This is different from 27920, chosen for PDS. Other considerations (details beyond the scope of this course) make 32720 better for PDSE.

Also note this at the top right:



Allocated blocks is 6. We specified 5 primary space blocks. We can infer that the PDSE's directory has, initially, 1 block.

On a PDS, there will be a maximum number of directory blocks. On a PDSE, you see "NOLIMIT".

End of exercise

Exercise 3. ISPF editor primary commands

Estimated time

00:30

Overview

In the previous exercise, you created three data sets: a sequential data set, a partitioned data set, and a partitioned data set extended. In this exercise, you will create a member in the previously created partitioned data set. You will then edit the member and copy a member from a different data set into the one you created. After modifying the member, you will execute a REXX exec and view its output.

Objectives

- Create a member in a partitioned data set
- Edit the member
- Copy a member
- Execute a REXX exec

References

SC34-4823	*Interactive System Productivity Facility (ISPF) User's Guide*
GC28-1758	*MVS JCL User's Guide*
SC26-7410	*z/OS DFSMS Using Data Sets*
SG24-7419	*Implementing REXX Support in SDSF*

Exercise instructions

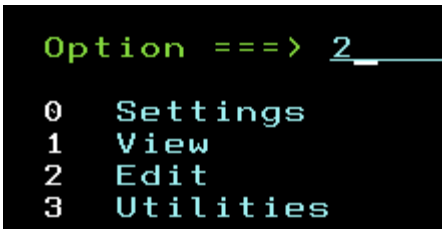
Preface

- This exercise depends on the successful completion of the previous exercises.

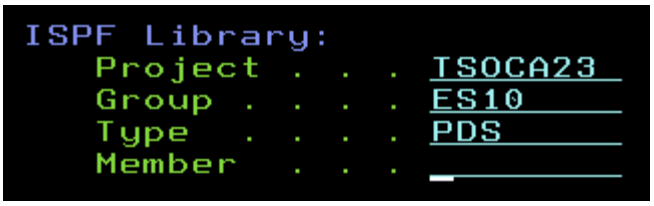
Section 1: Create a PDS member

In the previous exercise, you created a Partitioned Data Set (PDS) named ***userid*.ES10.PDS**. The *userid* is the user ID you used to log on to TSO with.

__ 1. From the ISPF Primary Option Menu, access the **Edit Entry Panel** by **entering 2** (Edit) on the command line (remember to **press Enter** after typing in **2**):



__ 2. The Edit Entry Panel will open. Ensure that the partitioned data set you created in the previous exercise is in the ISPF Library:



If the data set under ISPF Library is not the PDS you created earlier, make the necessary changes:

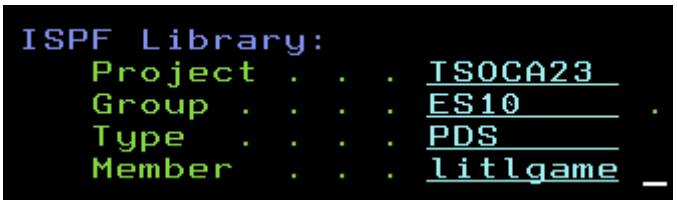
If Project doesn't show your TSO userid, **press Tab** until you get to Project and **enter your TSO userid**. Not TSOCA23, that's just an example.

If you pressed Tab too many times and skipped the field you wanted, use SHIFT + Tab to go back, or keep pressing Tab until the cursor wraps round and lands under the field.

*If Group doesn't contain **ES10***, **press Tab** until the cursor is next to Group and **enter ES10**.

*If Type doesn't contain **PDS***, **press Tab** until the cursor is next to Type and **enter PDS**.

__ 3. Create a member named **LITLGAME**. **Press Tab** until the cursor is next to Member and **enter LITLGAME**, then **press Enter**.



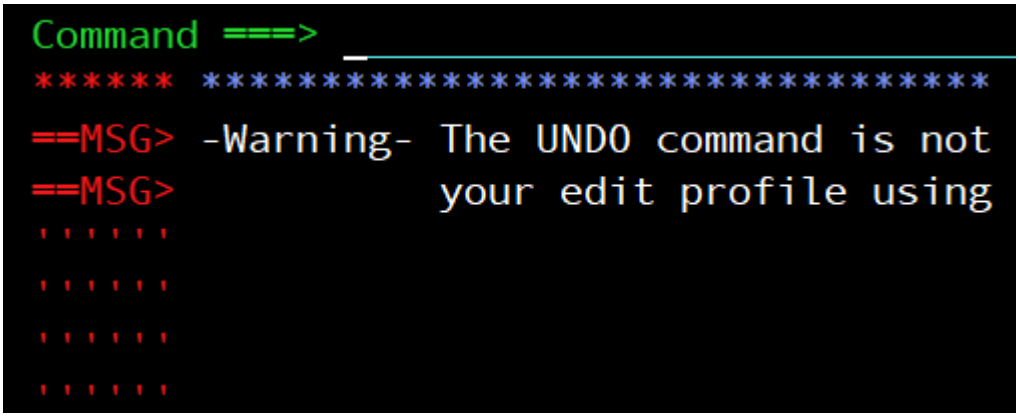
Note

Recall that, in z/OS, data set and member names are not case-sensitive. You can type **LITLGAME** or **litlgame**; the member name will always be uppercase.

Section 2: Edit the LITLGAME member

Populate LITLGAME with initial data

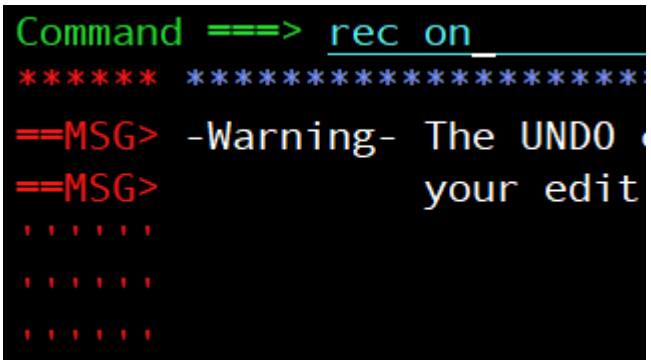
__ 4. The editor panel opens, showing an empty member:



Note the message “-Warning- The UNDO command is not available until you change your edit profile using the command RECOVERY ON.”

As mentioned earlier, the best thing to do in this case is to enter the command RECOVERY ON, or REC ON. This will remove the message and enable the UNDO command, which could be handy if you make changes by mistake.

So, **enter REC ON** (remember commands are not case sensitive, we show them in uppercase for readability, but you can enter them in lowercase):



The warning message disappears:

Note that the empty lines (those with "……" on the left) also disappear and what you see is an empty member (there is a line for "Top of Data" and another with "Bottom of Data", with nothing in between.

We are ready to fill in LITLGAME with our data.

__ 5. One way of filling in an empty member is to type the contents we want. Instead of doing that, we will copy the contents from another data set which contains a member with the data we need.

The data set containing the member we want is **D80WW.ES10V15.EXEC.**

Inside that data set, there is a member called **SKELEXEC**.

We will copy **SKELEXEC** to our empty **LITLGAME**.

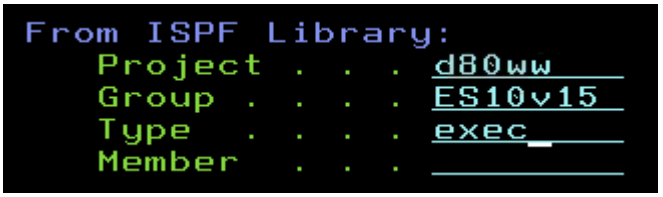
__ 6. **Enter COPY** on the command line:

This opens the **Edit/View - Copy panel**, showing the data set from which to copy the data (hint: it's not the one we want!):

The first line (“Current”) shows *where we’re copying **to**:* the LITLGAME member in your PDS data set. So far so good.

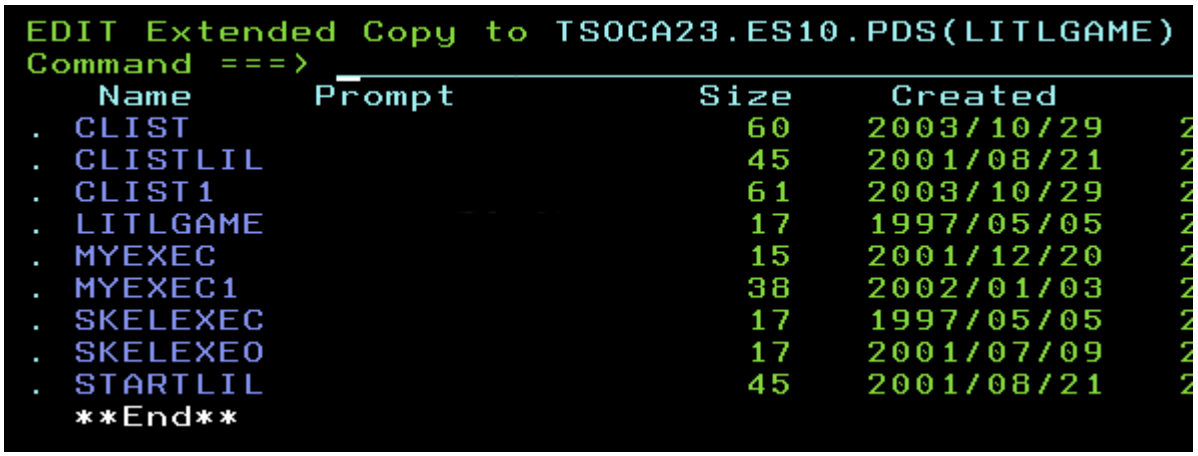
The next section (“From ISPF Library”) says it wants to copy a member from our PDS data set. Not what we want (remember we want to copy the member **SKELEXEC** from data set **D80WW.ES10V15.EXEC**). So what do we do?

__ 7. Enter **D80WW, ES10V15,** and **EXEC** next to Project, Group, and Type (press Tab to get the cursor to those fields):

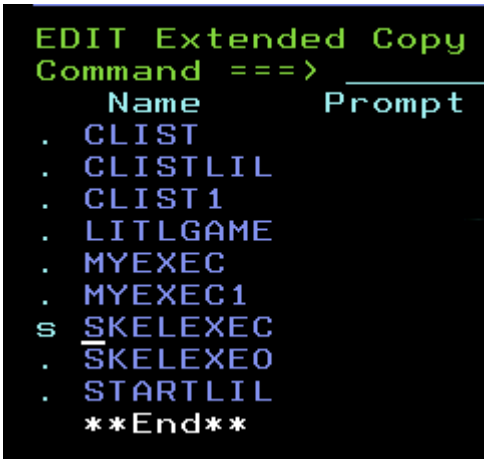


You can, if you want, enter SKELEXEC in Member and press Enter. We’ll show you another way, which you may prefer as it saves you typing the member name.

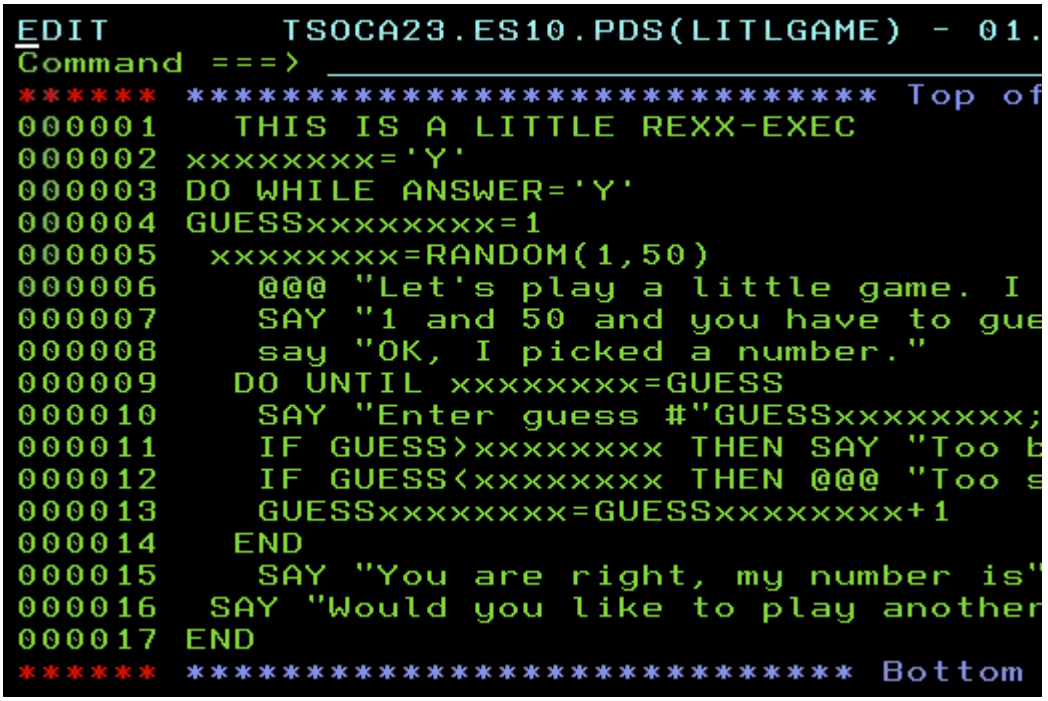
Press Enter. This opens the Edit Extended Copy panel, showing the list of members in **D80WW.ES10V15.EXEC**:



__ 8. **Press Tab** until the cursor is next to SKELEXEC and **type S** (select):

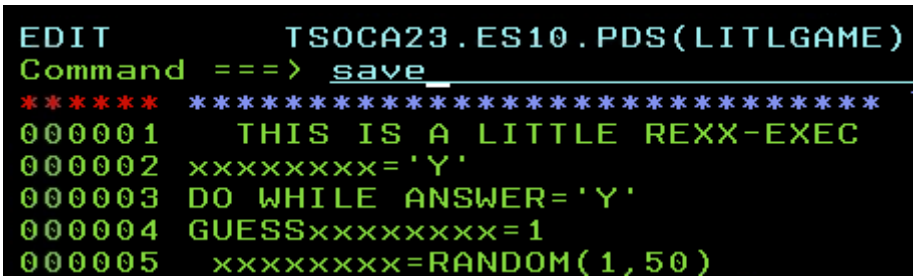


Press Enter. This copies SKELEXEC to LITLGAME and goes back to LITLGAME in the Edit panel, now showing the data just copied (showing partial contents to fit this page):



We will use the editor to change the character strings “xxxxxxxx” and “@@@”.

Optional, ***but always a good idea****:* **type SAVE on the command line and press Enter**.

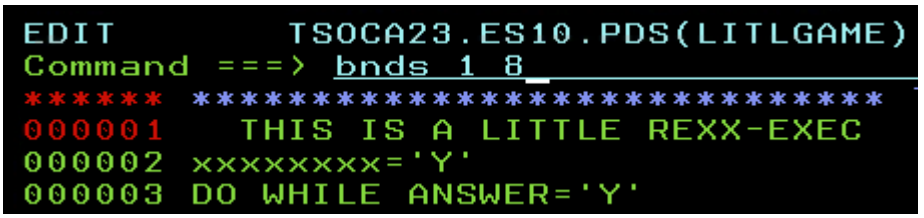


This is because, until now, nothing has been written to the data set (that is, to disk). If there was a crash, your work would be lost and you would have to start again from Step 1.

Make changes to the data just copied

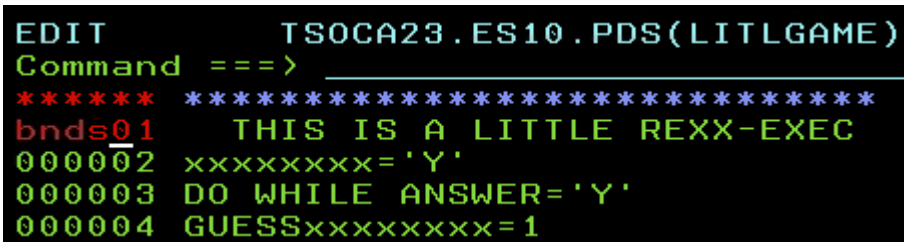
First, we will set the boundaries to columns 1 to 8, then change all **xxxxxxxx** to the word **ANSWER**.

__ 9. Enter **BNDS 1 8** on the command line:

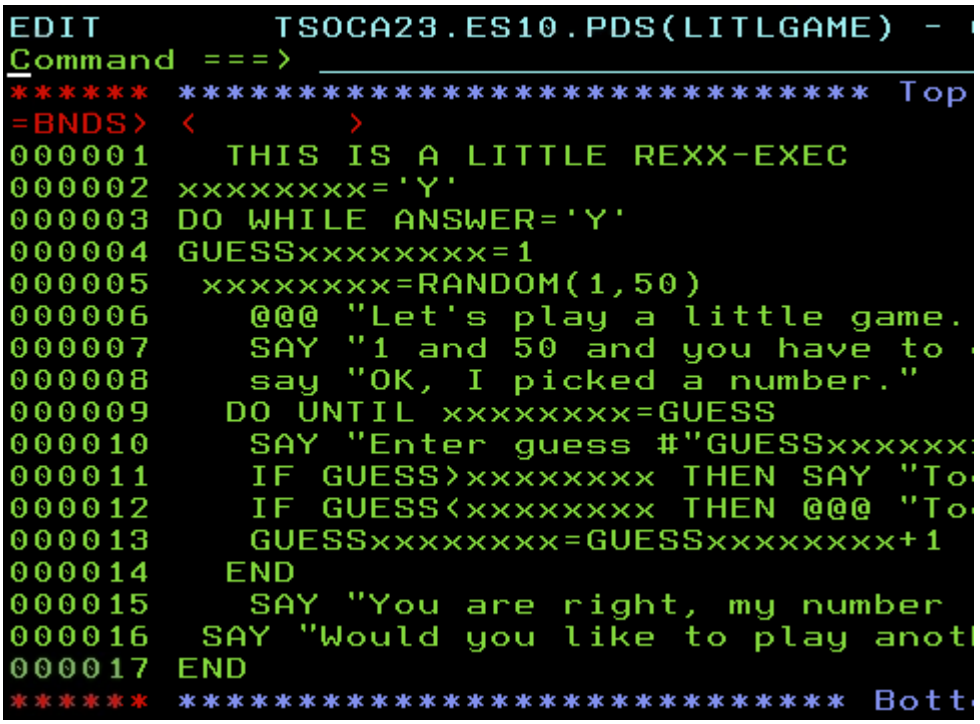


This means that FIND and CHANGE commands will only apply to data within columns 1-8. But how do we know it worked? Glad you asked!

__ 10. To check what the column boundaries are, **type BNDS on any of the numbers on the left** and **press Enter** (**press TAB** to place the cursor at one of the numbers, in our case, we went to 000001):



This will add a new line (which is not part of the data) showing the boundaries with “<“ (first column in boundary) and “>” (last):

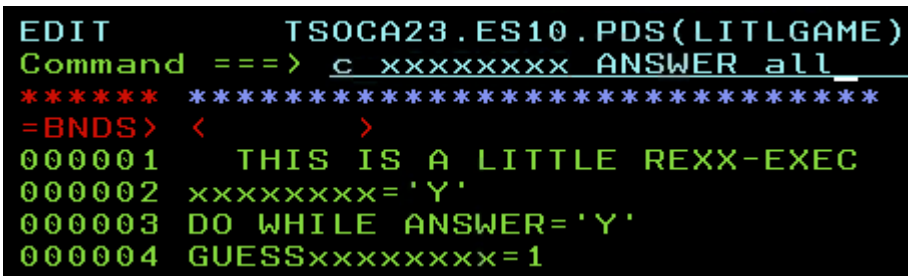


Recall that we want to change all **xxxxxxxx** to the word **ANSWER**. Looking at the member contents, the only **xxxxxxxx** within columns 1-8 is the one at line 2.

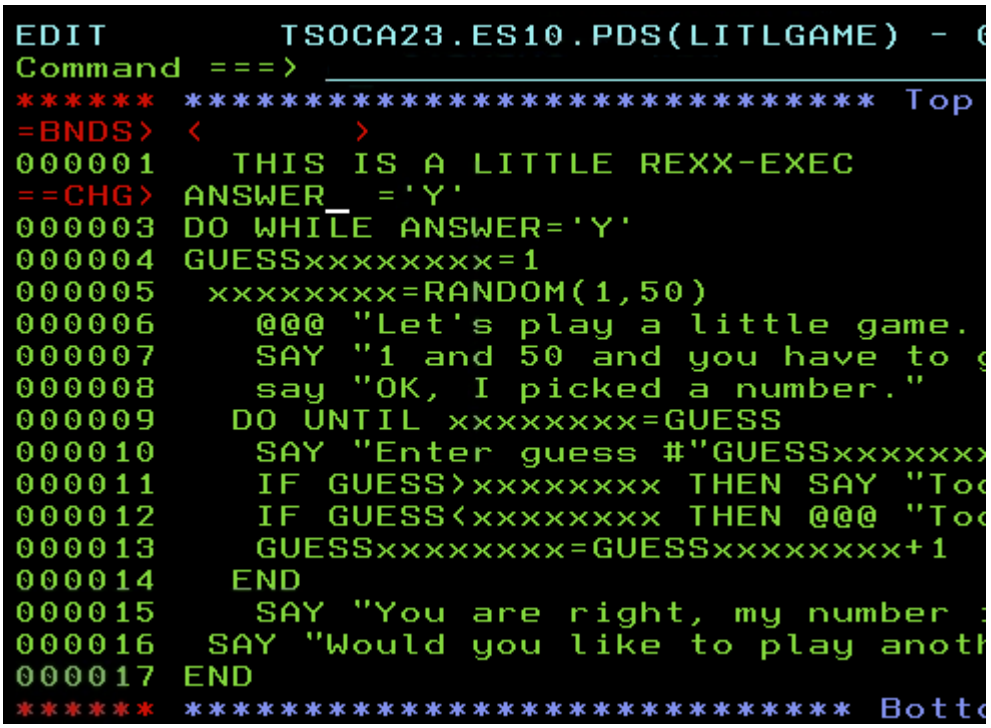
Let's see how that works.

__ 11. OK, time to change all **xxxxxxxx** to the word **ANSWER**.

On the command line, enter **C xxxxxxxx ANSWER ALL** and **press Enter**:



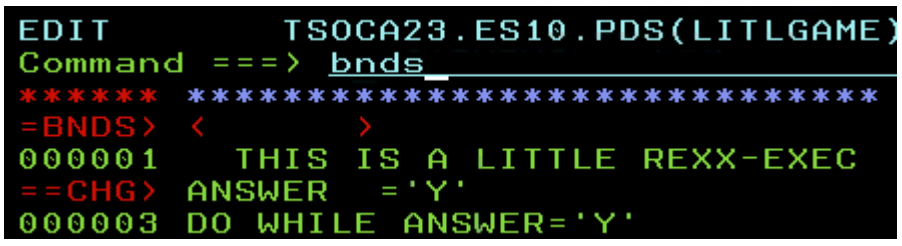
After pressing Enter, the changed contents should look like this:



Note, to the left of record 2, “==CHG>”, indicating that this line was changed. Also note, no other line shows “==CHG>” (because all other instances of **xxxxxxxx** were outside the 1-8 column boundary).

__ 12. We will now reset the boundaries to 1-80 and change all **xxxxxxxx** to the word **NUMBER**.

First, to reset the boundaries, **enter BNDS** on the command line. BNDS without operands resets the boundaries to the whole record:

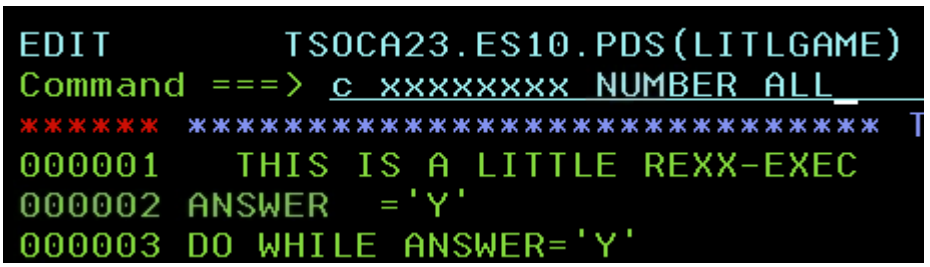


After **pressing Enter**, the BNDS line reflects the new (1-80) boundary:

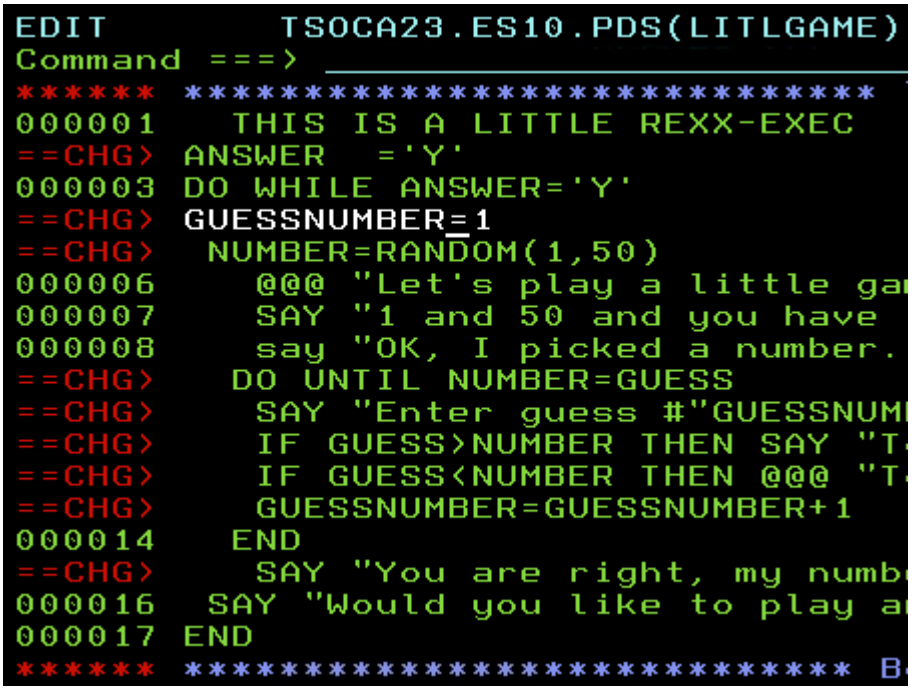
__ 13. We don't need the BNDS line any more, so we'll delete it. **Enter d** (delete) on "=BNDS>":

After **pressing Enter**, the boundary line disappears.

__ 14. To change all **xxxxxxxx** to the word **NUMBER**, enter **C xxxxxxxx NUMBER ALL** on the command line and press Enter:

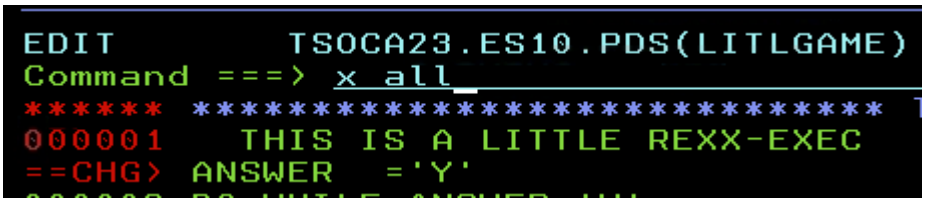


After pressing Enter, you'll see all the changes highlighted ("==CHG>" on the left):



__ 15. What we're doing next doesn't make much sense, as there are better ways of doing it, but we'll take the opportunity to show you editor functions that could be useful in other situations.

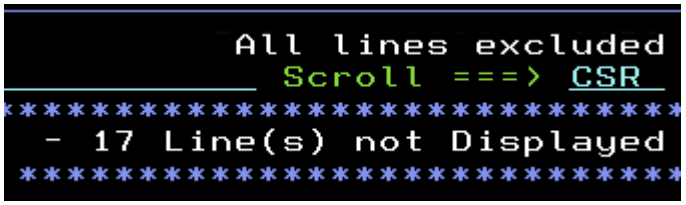
Exclude all of the lines from the display. **Enter X ALL** on the command line:



After pressing Enter, you'll see (splitting the display into left and right to fit this page).

On the left:

On the right:



Information

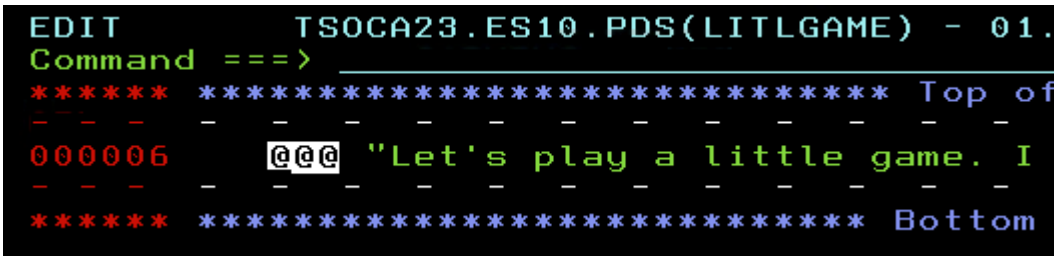
That's interesting, excluding all lines. Sounds like a good party trick. What is it for?

Well, the FIND and CHANGE commands have the option of operating on excluded or non-excluded lines, giving you better control over what to find or change.

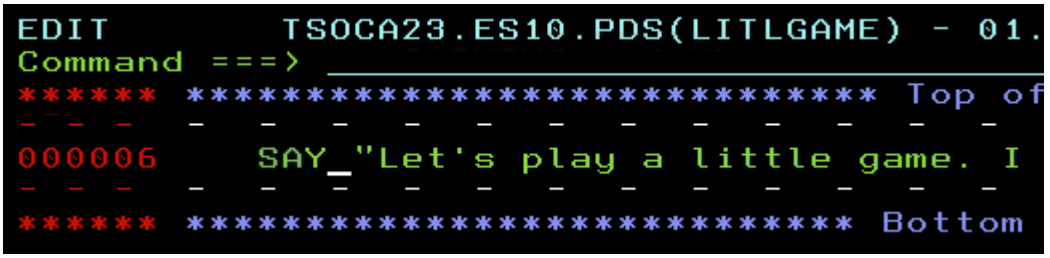
If there is a section of code in a program that you don't want to change, you can exclude that section and then use C XXX YYY NX ALL (change all *non-excluded* instances of XXX to YYY).

__ 16. Display the first line containing **@@@** and type over **@@@** with the word **SAY**.

You do this by **F @@@** (FIND @@@) on the command line. After **pressing Enter**, the first line that contains @@@ appears:

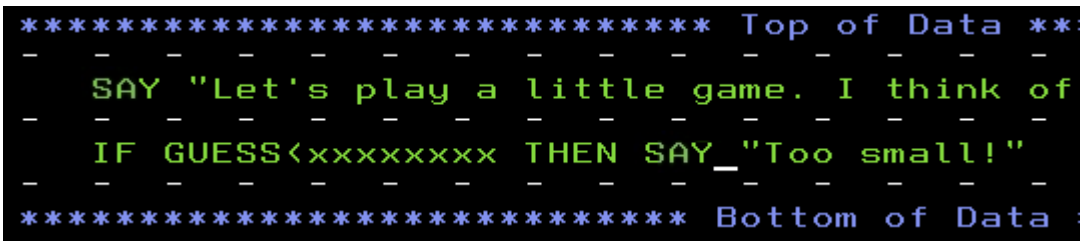


Type **SAY** over **@@@**:

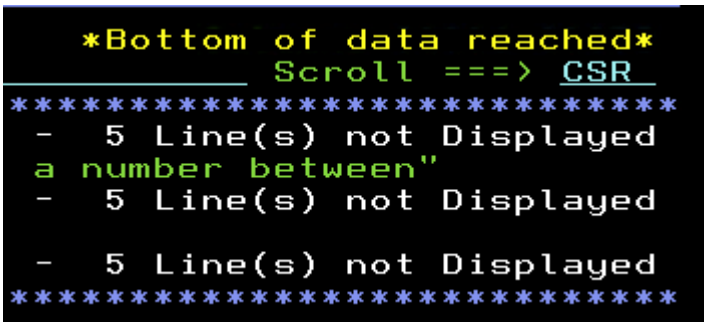


__ 17. Use the RFIND (REPEAT FIND) key (**F5**) to find all further occurrences of **@@@** and type over them with the word **SAY**.

Each time you **press F5**, a new line that contains @@@ will appear. **Type SAY over @@@** and **press F5 again**.

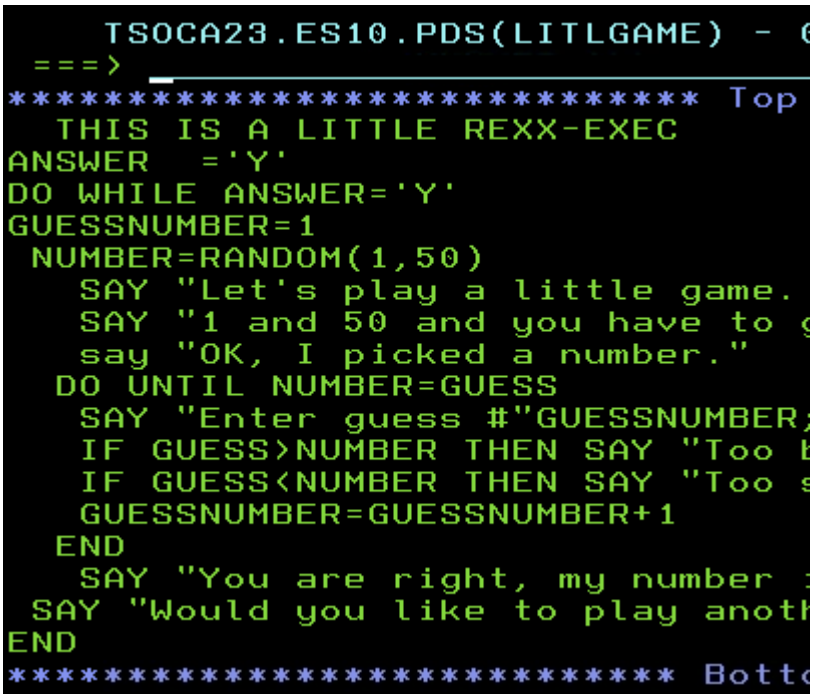


When there are no more instances of @@@ in the member, you'll see the message "Bottom of data reached" on the top right:



__ 18. Show all of the lines on the display that have been previously excluded. **Enter RESET** (or **RES**) on the command line:

The excluded lines now reappear:



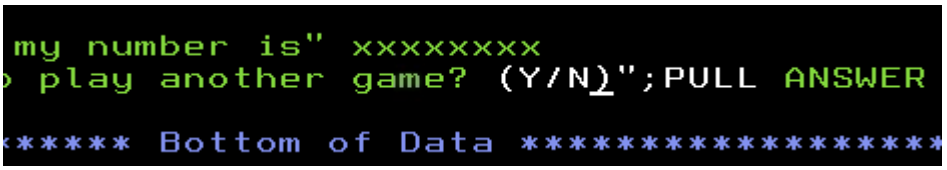
This is a REXX program, which we will (optionally) run next. Before that, there is one more change we must apply: the first line in a REXX program must be a comment (text between **/*** and ***/**) that contains the word **REXX**.

Press Tab to place the cursor in the first line and change it from
THIS IS A LITTLE REXX-EXEC...

...to
/*THIS IS A LITTLE REXX-EXEC*/:

__ 19. Set the boundaries to **40-50**. You know this: enter **BNDS 40 50** on the command line.

__ 20. Change **SAY** to **Y/N**. Enter **C SAY Y/N** on the command line and **press Enter**. You'll see this change near the end of the member:



__ 21. Reset the boundaries to 1-80: **Enter BNDS** on the command line.

__ 22. **Enter SAVE** on the command line to save your changes. ***This is important***, as the program will run from disk, and we need the latest version, with all the changes written out. Check that you see "Member LITLGAME saved" at the top right after pressing Enter:

Optional

Enter **HILITE AUTO** on the command line to enable the coloring options for language sensitive coloring in the ISPF editor.

You will see that different elements of the program (comments, instructions, variables...) are shown with different colors:

```
/*THIS IS A LITTLE REXX-EXEC*/
ANSWER  ='Y'
DO WHILE ANSWER='Y'
GUESSNUMBER=1
 NUMBER=RANDOM(1,50)
   SAY "Let's play a little game. I think of
   SAY "1 and 50 and you have to guess it!"
   say "OK, I picked a number."
  DO UNTIL NUMBER=GUESS
   SAY "Enter guess #"GUESSNUMBER;PULL GUESS
   IF GUESS>NUMBER THEN SAY "Too big!"
   IF GUESS<NUMBER THEN SAY "Too small!"
   GUESSNUMBER=GUESSNUMBER+1
```

__ 23. **Optional:** run the program. *Don't worry if the program doesn't run,* the objective of this lab was to show how the editor works.

Start the **REXX program (also called REXX EXEC)** by entering the following on the command line: **TSO EXEC '*userid*.ES10.PDS(LITLGAME)'**

You can also enter EX instead of EXEC: **TSO EX '*userid*.ES10.PDS(LITLGAME)'.**

For example ***(remember your userid will be different):***

```
EDIT       TSOCA23.ES10.PDS(LITLGAME) - 01.00
Command ===> tso ex 'TSOCA23.ES10.PDS(LITLGAME)'
****** ***************************** Top of Data *
```

Press Enter. The program starts; you'll see this first:

```
Let's play a little game. I think of a number between
1 and 50 and you have to guess it!
OK, I picked a number.
***
```

See the three asterisks (***)? **Press Enter!**

Enter your guesses, then enter ‘n’ to stop the program:

```
 Enter guess #1
25
 Too big!
 Enter guess #2
12
 Too big!
 Enter guess #3
6
 Too big!
 Enter guess #4
3
 Too small!
 Enter guess #5
4
 Too small!
 Enter guess #6
5
 You are right, my number is 5
 Would you like to play another game? (Y/N)
n
 ***
```

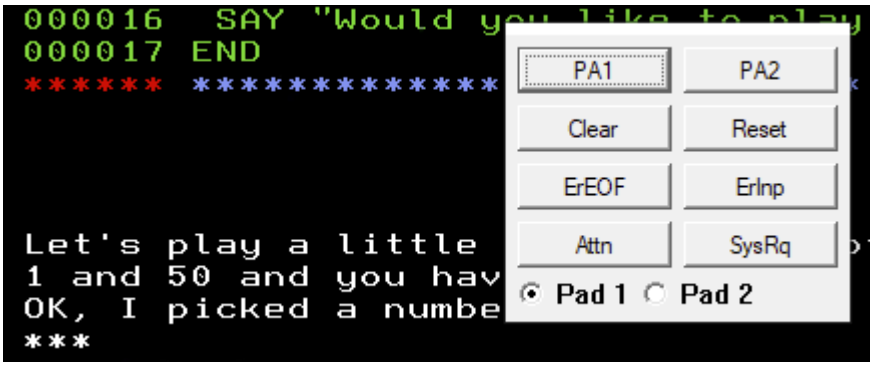
Again, three asterisks - **press Enter**. You’ll be back to editing LITLGAME.

__ 24. What if it doesn’t work? Compare your version of LITLGAME with the one below, and make sure yours matches by making the necessary changes in the editor. **Remember to SAVE when you’re done.**

```
/*THIS IS A LITTLE REXX-EXEC*/
ANSWER  ='Y'
DO WHILE ANSWER='Y'
GUESSNUMBER=1
 NUMBER=RANDOM(1,50)
   SAY "Let's play a little game. I think of a number between"
   SAY "1 and 50 and you have to guess it!"
   say "OK, I picked a number."
  DO UNTIL NUMBER=GUESS
   SAY "Enter guess #"GUESSNUMBER;PULL GUESS
   IF GUESS>NUMBER THEN SAY "Too big!"
   IF GUESS<NUMBER THEN SAY "Too small!"
   GUESSNUMBER=GUESSNUMBER+1
  END
   SAY "You are right, my number is" NUMBER
 SAY "Would you like to play another game? (Y/N)";PULL ANSWER
END
```

Section 3: Ending the exec

__ 25. If you don't want to play the game once you started the program, you can cancel it: **press PA1** on the keyboard. **Right-click anywhere on the panel** to display the pop-up keypad and **click on PA1**:

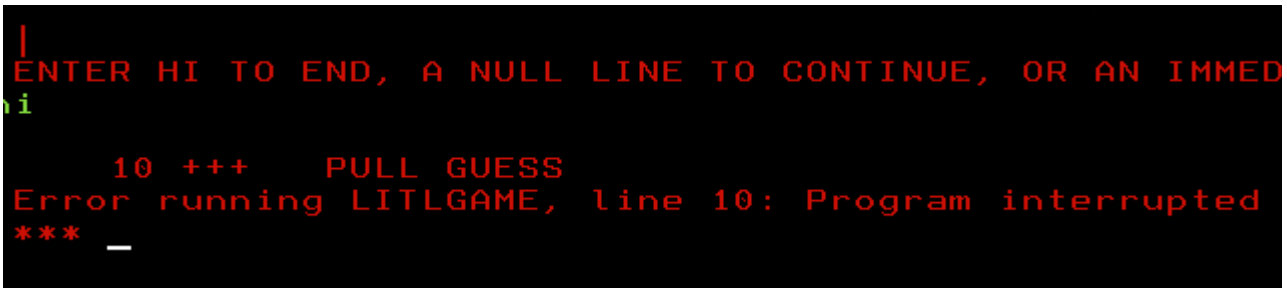


You'll see this after pressing **PA1**:

,

__ 26. Enter **HI** (**H**alt **I**nterpreter) to end the program:

Note you may have to press Enter twice. The program will end:



Press Enter to return to the Editor.

__ 27. When you have finished playing computer games, take a few minutes to inspect the code.

LITLGAME.

LITLGAME is written in a procedural language, called REXX.

REXX programs (or execs) can be compiled or not, as you choose. This program has not been compiled, and so it is interpreted as the instructions are executed, resulting in poorer performance, but less administration work.

__ 28. Before logging off or continue on to the next exercise, *ensure that you reset the **BOUNDS*** (**enter BNDS** on the command line and **press Enter**).

__ 29. You can stay logged on if you plan to do the next exercise now. If you want to logoff:

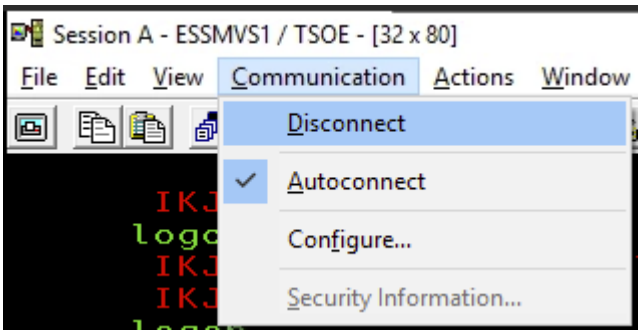
Enter **=x** on the command line an **press Enter**.

This will end ISPF and take you to the TSO command line, where you'll see the TSO "**READY**" prompt:

__ 30. Type **LOGOFF** and **press Enter**:

You'll be logged off and shown the logon prompt, in case you want to log back on:

__ 31. Close the terminal emulator. Click on **Communication** (at the very top of the PCOMM window, then click on **Disconnect**:



Now you can close the window (X at the top right-hand corner, like any other Windows application).

To start the terminal emulator again, double-click on the desktop icon (see Exercise 1 if you need a refresher).

End of exercise

Exercise 4. ISPF editor line commands

Estimated time

00:30

Overview

In this exercise, you will create a member in a previously allocated partitioned data set. You perform functions, such as copying data, overlaying commands, inserting and repeating lines using the newly created member.

Objectives

- Create a member
- Copy data
- Overlay commands
- Insert lines
- Repeat lines

References

SC34-4823	*Interactive System Productivity Facility (ISPF) User's Guide*
GC28-1758	*MVS JCL User's Guide*
SC26-7410	*z/OS DFSMS Using Data Sets*

Exercise instructions

Preface

- This exercise depends on the successful completion of the previous exercises.

Section 1: Create a new member and copy data

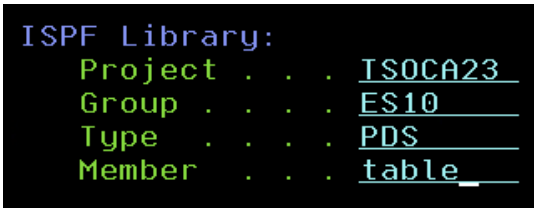
__ 1. Edit ***userid*.ES10.PDS** and create a new member called **TABLE**.

For details on how to edit, see the previous exercise. Here's a quick reminder:

Enter 2 (Edit) on the ISPF Main Menu command line. This opens the ISPF Edit Entry Panel.

Make sure that ISPF Library fields show **your userid**, **ES10**, and **PDS**. *If they do not,* **press Tab** to place the cursor on **Project (enter your userid)**, **Group (enter ES10)**, and **Type (enter PDS)**.
Press Tab to place the cursor next to Member, and enter **TABLE**.

You should see this:



Press Enter. This will open the editor panel and show an empty TABLE member.

If the **==MSG>** lines appear ("The UNDO command..."), enter **REC ON** on the command line to remove them.

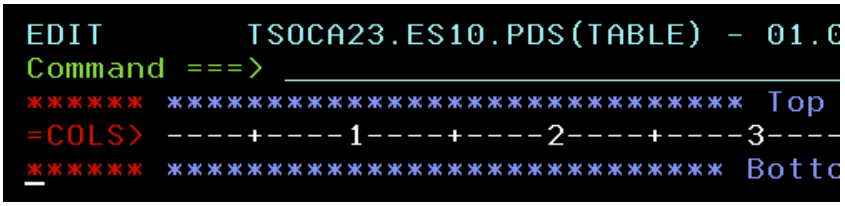
__ 2. Enter **HILITE AUTO** on the command line to enable the coloring options for language sensitive coloring in the ISPF editor.

__ 3. Did you remember to reset the boundaries at the end of the last exercise? Just in case, **enter BNDS** on the command line (and **press Enter**).

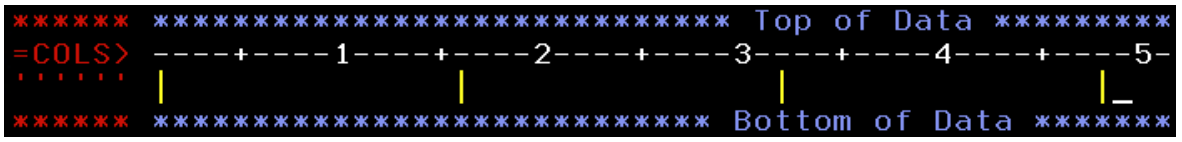
__ 4. **Tab the cursor to the second set of lines** ("Bottom of Data"), and enter **COLS** on the prefix area on the left.

Note: it is important that you skip the first line (“Top of Data”), as you cannot enter COLS there. Any other line is OK.

The ruler should appear, and should look like this:

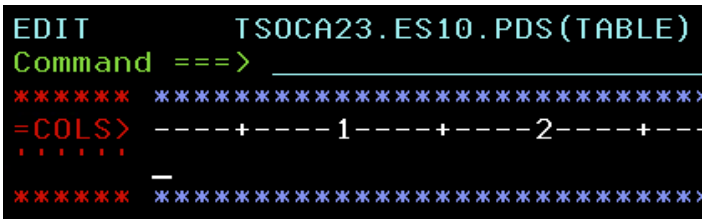


__ 5. You will now set up a line which looks like this (instructions next):

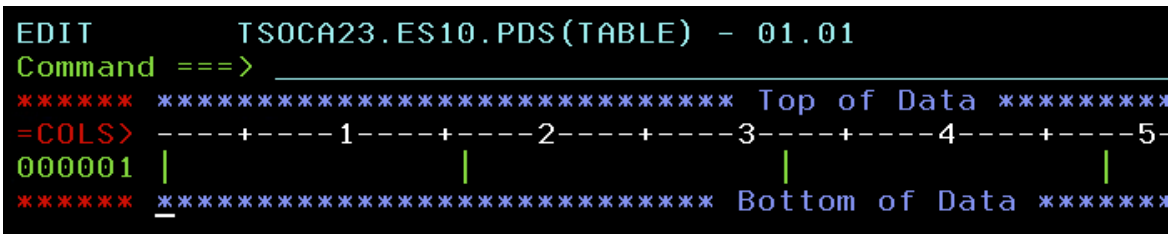


To do this, first **enter I** (Insert) on the **=COLS>** prefix:

This will insert an empty line:



Enter vertical bars ("|") at columns **1, 16, 32, and 48** and **press Enter**. This gives you a new empty line in case you want more lines. As you don't, **press Enter again** to remove that empty line.

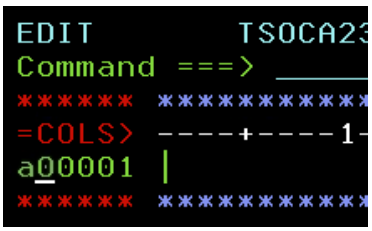


__ 6. Copy member **TABLE** from **D80WW.ES10V15.CNTL** after line 1.

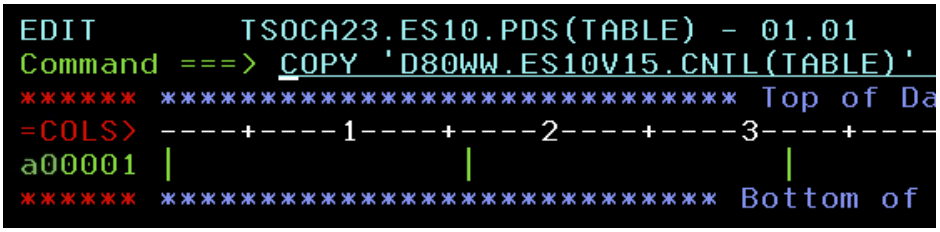
In the last exercise, you did this by entering **COPY** in the Edit command line (if you recall, this opened a panel where you selected the source data set and member).

Now we'll try a more direct method:

a. **Tab to the line 000001** prefix and **enter a** (a is for *after*; this tells the editor to place the copied records after line 1). *Do not press Enter yet*:



b. Tab to the command line and enter **COPY 'D80WW.ES10V15.CNTL(TABLE)'** on the Edit command line:



Note

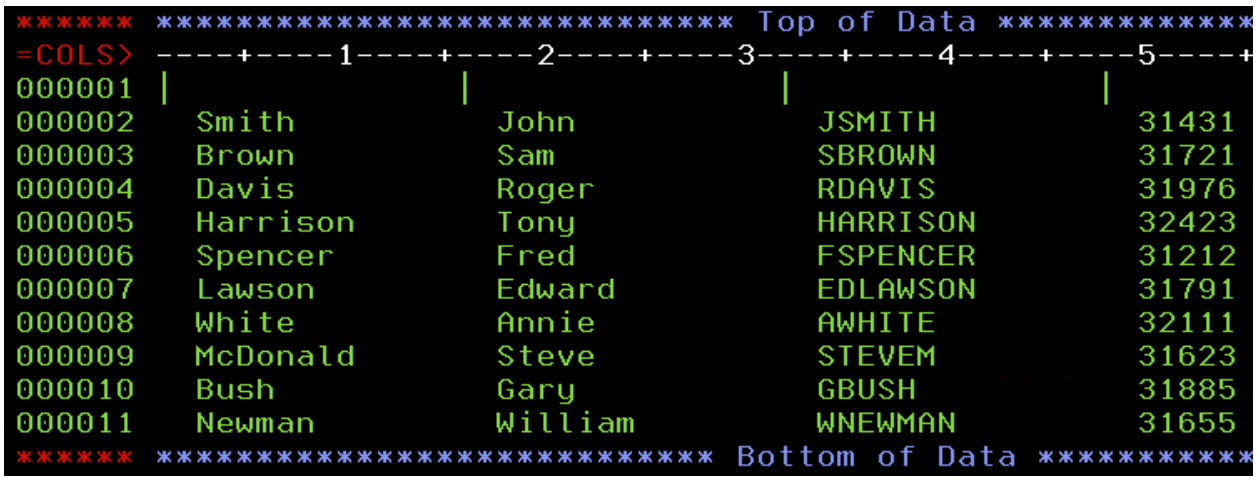
A brief note about the **'D80WW.ES10V15.CNTL(TABLE)'** notation. This is TSO way of referring to a dataset and, optionally, member (the other way we've seen, "the ISPF way", is to fill in Project, Group, Type, and Member under ISPF Library in an ISPF panel).

The format is **'data set name(member name)'**.

The single quotes are important. If you don't put single quotes around the data set and member, TSO will prefix your userid.

This may save you some typing if your data set name starts with your userid: instead of typing **'userid.ES10.PDS'** you can omit the userid and the single quotes: **ES10.PDS**.

c. **Press Enter**. The copied lines will appear:



d. Optional: We no longer need the ruler. If you want to remove it, **enter RES** (RESET) on the command line and **press Enter**.

Note

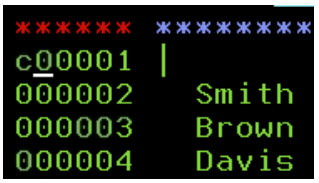
You know this, but just in case: if the **BOUNDS** command was not reset from the previous lab exercise, results in the following steps are unpredictable.
If you want to make sure, **enter BNDS** now in the command line and **press Enter**.

Section 2: Copy / overlay commands

Now you'll use **copy/overlay** (**c** and **oo**) to copy line 1 over the first four lines you copied in, so the result looks like this:

```
****************************** Top of Data **************
|                    |                    |                    |
  Smith              John                 JSMITH               31431
  Brown              Sam                  SBROWN               31721
  Davis              Roger                RDAVIS               31976
  Harrison           Tony                 HARRISON             32423
  Spencer            Fred                 FSPENCER             31212
  Lawson             Edward               EDLAWSON             31791
  White              Annie                AWHITE               32111
  McDonald           Steve                STEVEM               31623
  Bush               Gary                 GBUSH                31885
  Newman             William              WNEWMAN              31655
****************************** Bottom of Data ************
```

__ 7. First **enter c** (copy) on the line 000001 prefix (*do not press Enter yet*):

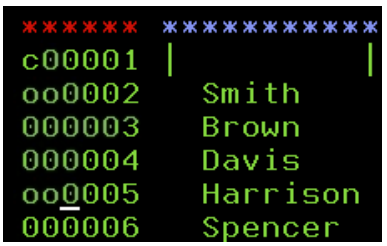


This tells the editor that you want to copy line 1 to another place in the member.

Usually, you will go to another line and enter **a** (after) or **b** (before). The editor will insert a copy of line 1 either after or before the target line.

We'll try something a bit more interesting: instead of copying before or after a line, we will *overlay* lines with the contents of line 1. We'll go further, instead of overlaying one line, we'll overlay four.

__ 8. **Tab to line 000002** and **enter oo**, indicating the first line to be overlaid, then **tab to line 000005** and **enter oo** (this marks the last line to be overlaid). The prefix area should look like this:

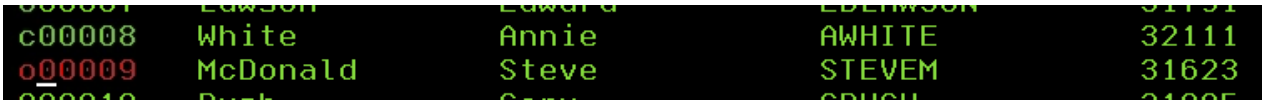


Press Enter. You should see this:

Magic! What did just happen? Copy/overlay copied *non-blank* data from line 1 to *blank* columns in lines 2-5. Note that copy/overlay *only replaces blank columns*. If a column in

the target is not blank, it is not replaced by data from the source.

Optional: you can verify this by doing an experiment. Try to copy/overlay from line 8 to line 9:



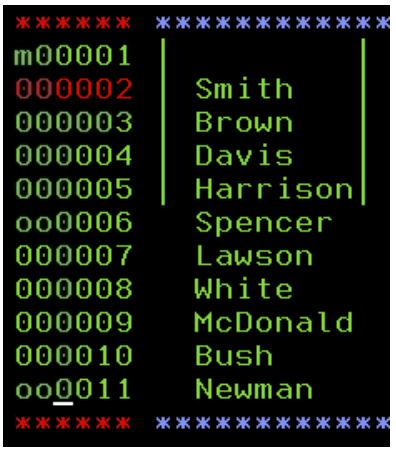
Nothing happens, because there are no non-blank columns in line 8 with corresponding blank columns in line 9:

Section 3: Insert lines

Now we'll use move/overlay, that is **m** and **oo**, to move line 1 over the last six lines you copied in, so the result looks like the following:

Note the original line 1, with the vertical bars, is no longer there. This is the difference between copy (where the original remains in place) and move.

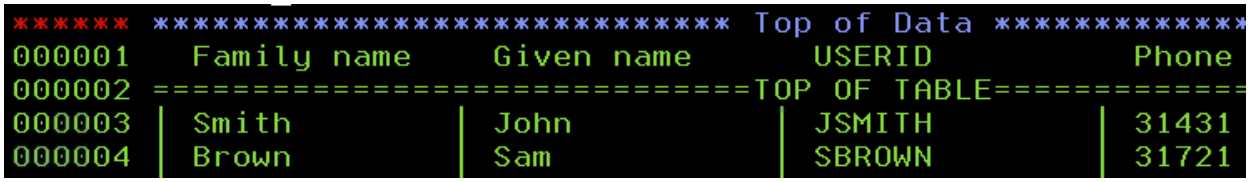
__ 9. **Tab to line 1** and **type m**. Then **tab to line 6** and **type oo**. Finally, **tab to line 11** (the last line) and **type oo**:



__ 10. **Press Enter**. You should see:

__ 11. If you haven't done it already, this may be a good time to remove the ruler. **Enter RES** (RESET) on the command line and **press Enter**.

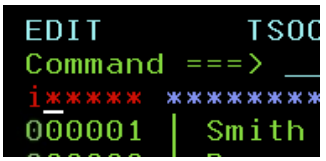
Next, you'll insert the following heading lines at the top of the table...



...and the following trailing line at the bottom of the table:

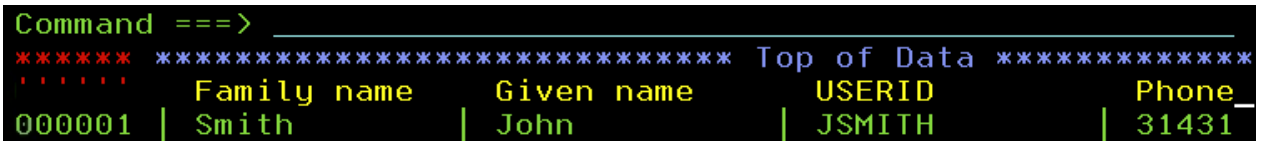
To do the above:

__ 12. First, **tab to the top prefix** (before 000001) and **enter i** (insert):

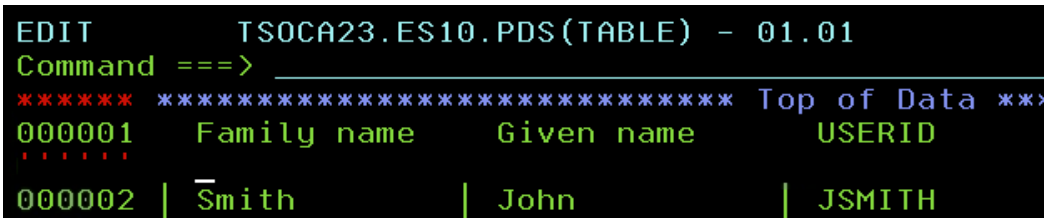


Press Enter. The inserted line appears:

__ 13. Type the headings in the inserted line:



Press Enter. A new empty line (between lines 1 and 2) should appear:



If you did something different and there is no empty line: tab to line 1, enter i, and press Enter to insert an empty line.

__ 14. Type "**===...===TOP OF TABLE===...===**" in the inserted line, then **Press Enter**. A new empty line appears automatically, in case you want more. As you don't want more lines, **press Enter** again (the new empty line disappears). The result should look like this:

Note the "=" characters fill the line. They were omitted from the screenshot to fit the page.

__ 15. Copy line 2 after the last line and change "TOP" to "BOTTOM".

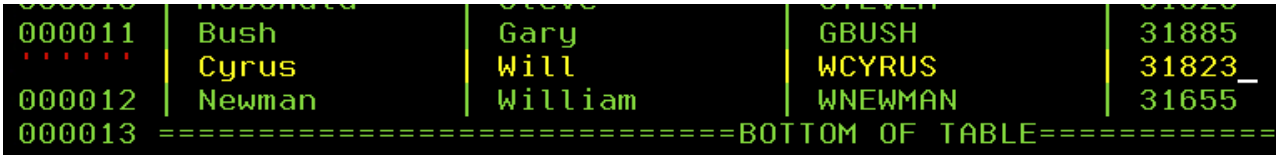
Tab to line 2 and **type c** (copy). Then **tab to the last line, 12**, and **type a** (after):

Press Enter. You should see:

__ 16. **Type BOTTOM OF TABLE**, aligned with "Bottom of Data" and **press Enter**:

Section 4: Add and repeat lines

__ 17. Add a new line after **Bush** (**tab to line 11**, **enter i**) and **type Cyrus, Will, WCYRUS, 31823** (remember to also type the vertical bars):

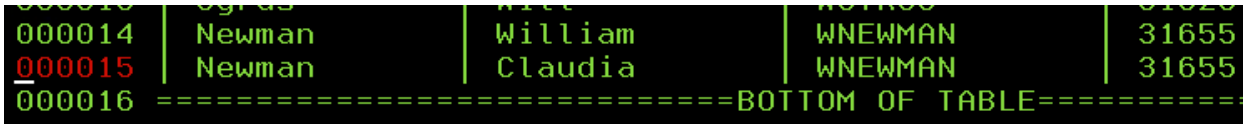


Press Enter twice after typing.

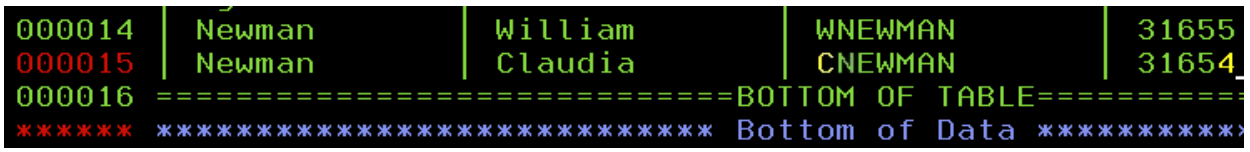
__ 18. Repeat entry **Davis** (**tab to line 5**, **enter r**) and **change the repeated line to Davis, Sarah, SDAVIS, 31945**:

__ 19. Insert a new line after **Newman**, and enter **Claudia** as first name:

__ 20. Use copy/overlay, that is **c** and **o**, to copy the old entry Newman (**tab to line 14, type c**) over the new line (**tab to line 15, enter o**):



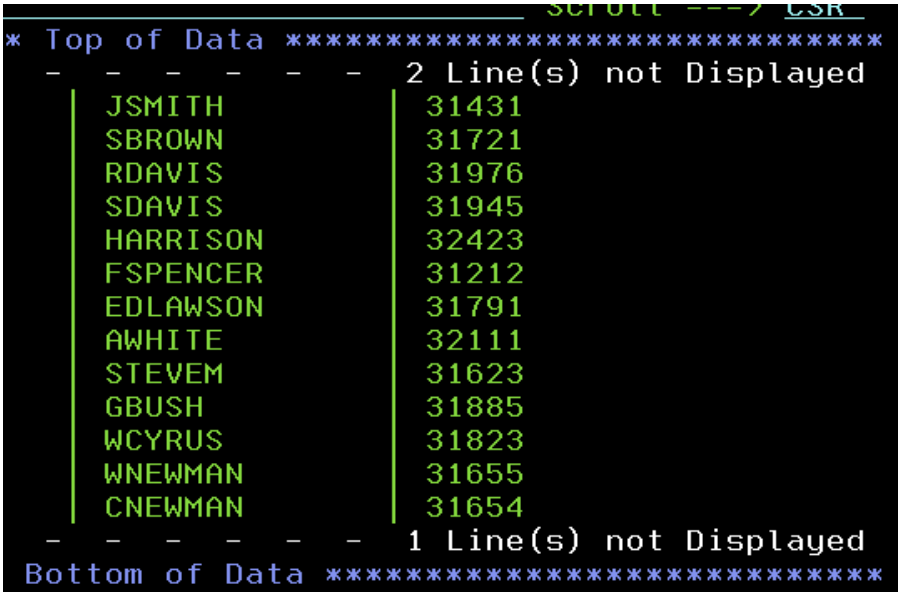
__ 21. Change the user ID to **CNEWMAN** and the phone to **31654**:



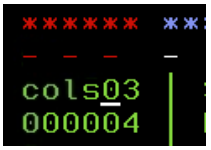
Finally, we'll sort the lines by Family name and Given name.

__ 22. Exclude the header and trailer lines. **Type x on lines 1, 2 and 16**:

Press Enter. The lines where you entered x disappear (they are not deleted, just hidden). This is the right of the screen:



__ 23. Display the ruler, so we know which columns to sort. Enter COLS in the first line (any line is OK, apart from the top):



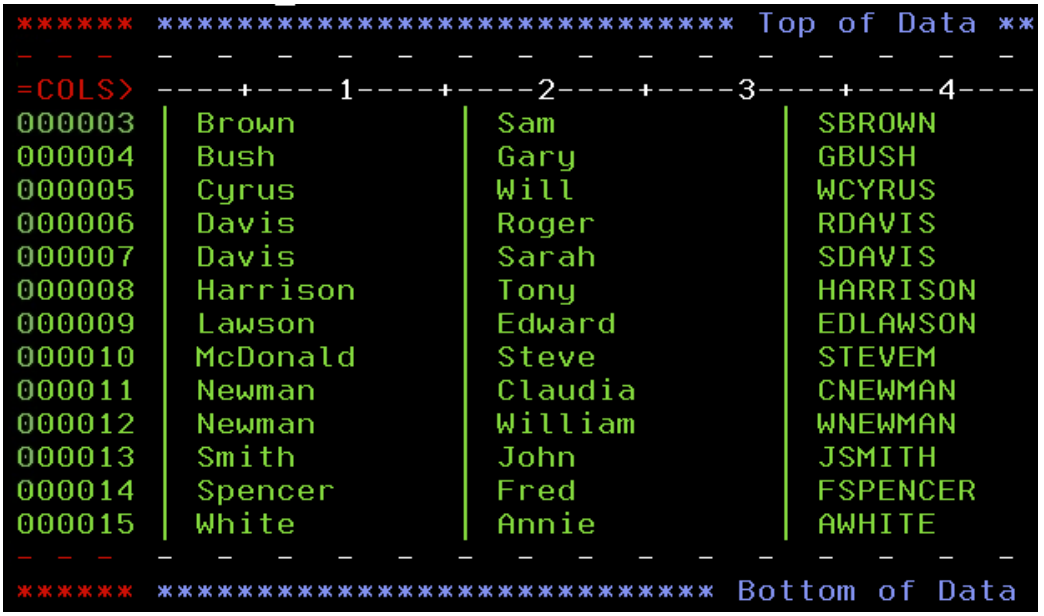
The ruler appears:

We can see that **Family name** is in columns **3 to 15** and **Given name** in columns **18 to 31**.

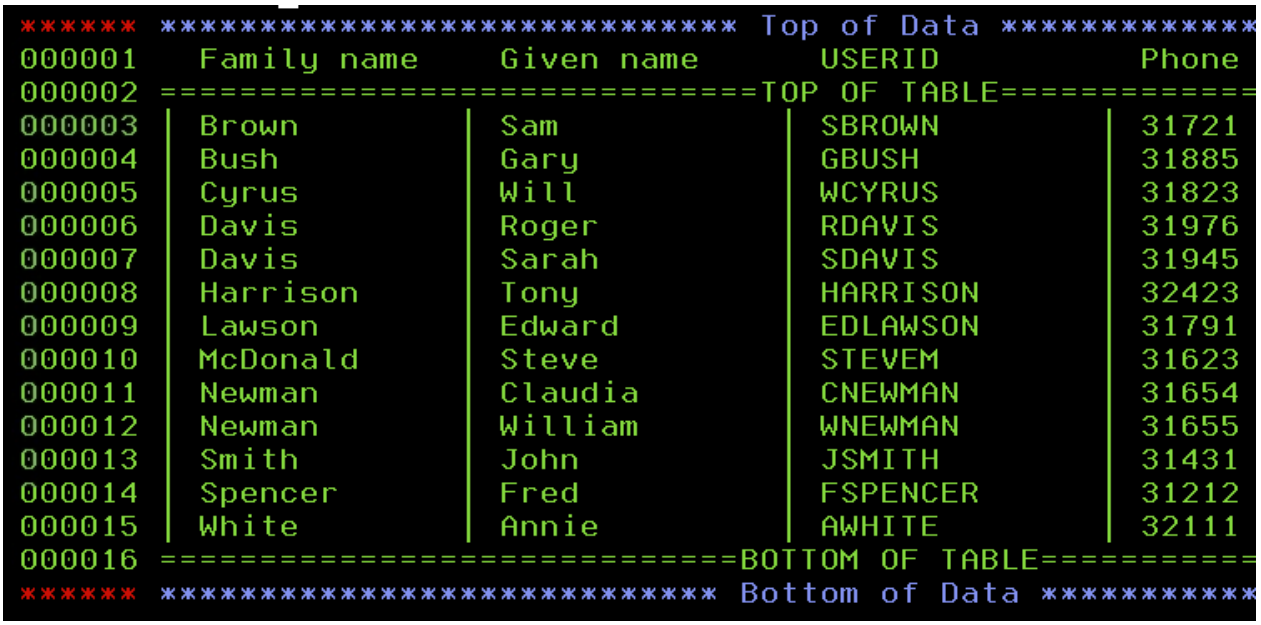
__ 24. To sort the lines by Family name followed by Given name, **enter SORT NX A 3 15 A 18 31**:

Where:
SORT: the SORT command.
NX: sort only non-excluded lines. The excluded lines remain where they are.
A 3 15: Ascending, columns 3 to 15 (Family name).
A 18 31: Ascending, columns 18 to 31 (Given name).

Press Enter. You should see:



__ 25. Enter RES (RESET) to show the hidden lines:



__ 26. Congratulations! Save your work by entering **Save** on the command line.

__ 27. **Press F3** to exit the editor (this would also save your work, if you forgot to do it). Keep **pressing F3** until you return to the Main Menu.

Information

What if you realize you made a mistake, and don't want to save your work?

In that case, you can **enter CAN** (or **CANCEL**) on the command line. This will exit the editor without saving the data.

If you entered **REC ON** (**RECOVERY ON**) when you first opened the data set in the editor, you can also **enter UNDO** to, well, undo the last change. You can repeat UNDO to reverse changes, one at a time, until the last SAVE.

__ 28. **Optional**. Logoff if you are not doing the next exercise immediately. (See instructions for logging off at the end of Exercise 1.)

End of exercise

Exercise 5. Copy, move, rename, delete data sets and members

Estimated time

00:30

Overview

In this exercise, you will allocate (create) data sets and create multiple members. After creating new members, you will add data to those members. Then, copy members from one data set to another. When completing this process, you learn how to delete data sets and members.

Objectives

- Allocate data sets
- Create members
- Add data to members
- Copy members from one data set to another
- Delete members
- Delete data sets

References

SC34-4823 *Interactive System Productivity Facility (ISPF) User's Guide*

Exercise instructions

Preface

- This exercise depends on the successful completion of the previous exercises.

Section 1: Copy, move, rename, delete data sets, and members

Allocate new datasets

We'll start by allocating two new data sets called ***userid*.ES10.INDATA** and ***userid*.ES10.OUTDATA**. The new data sets will be like ***userid*.ES10.PDS** (that is, they will have the same attributes, like record format, or size).

__ 1. First, we must go to the ISPF Data Set Utility panel. As you know, you can select 3 (Utilities) on the ISPF Main Menu, then 2 (Data Set).

But, but now, you're a pro, and you know that you can **enter 3.2** on the ISPF Main Menu command line to go directly to the Data Set Utility panel.

If you are not on the Main Menu, you can enter **=3.2** from any other panel to go directly to the Data Set Utility panel.

__ 2. When you tell ISPF to allocate a new data set, it will present a panel already filled with suggested attributes (space units, primary and secondary quantity, record size and format...).

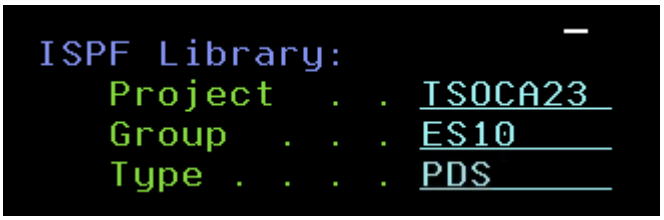
Q. Where do the suggested attributes come from?
A. ISPF shows the attributes from the last data set it used.

So, if we want to allocate a data set that has the same attributes as ***userid*.ES10.PDS**, we start by *displaying it*:

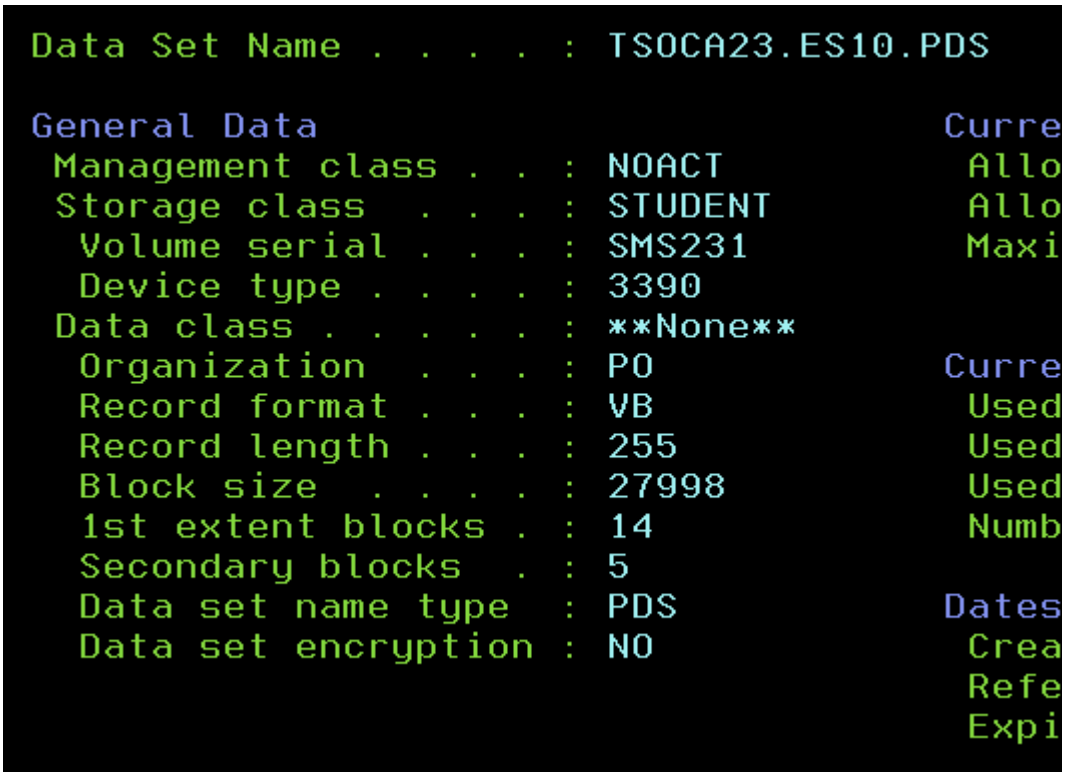
On the Data Set Utility panel, enter **your userid**, **ES10**, and **PDS** under ISPF Library:

Important

Remember that the userid in the screenshots (in the example below, TSOCA23) *is not what you will enter.* Wherever you see TSOCA23 (or any other userid), **you must use *your* TSO userid**, which you found under CREDENTIAL INFORMATION in the Course Lab Kit and used to logon to z/OS.



Press Enter. This will display the data set attributes (showing a partial screen to fit the page):



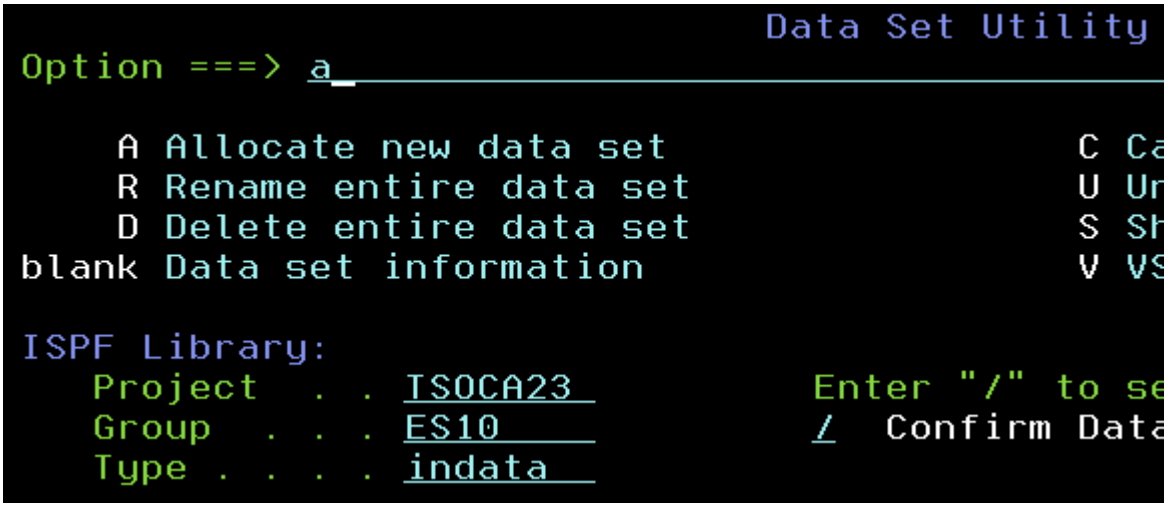
Having displayed the data set attributes, ISPF now remembers them and will use them when you allocate a new data set.

Press Enter again to return to the Data Set Utility panel.

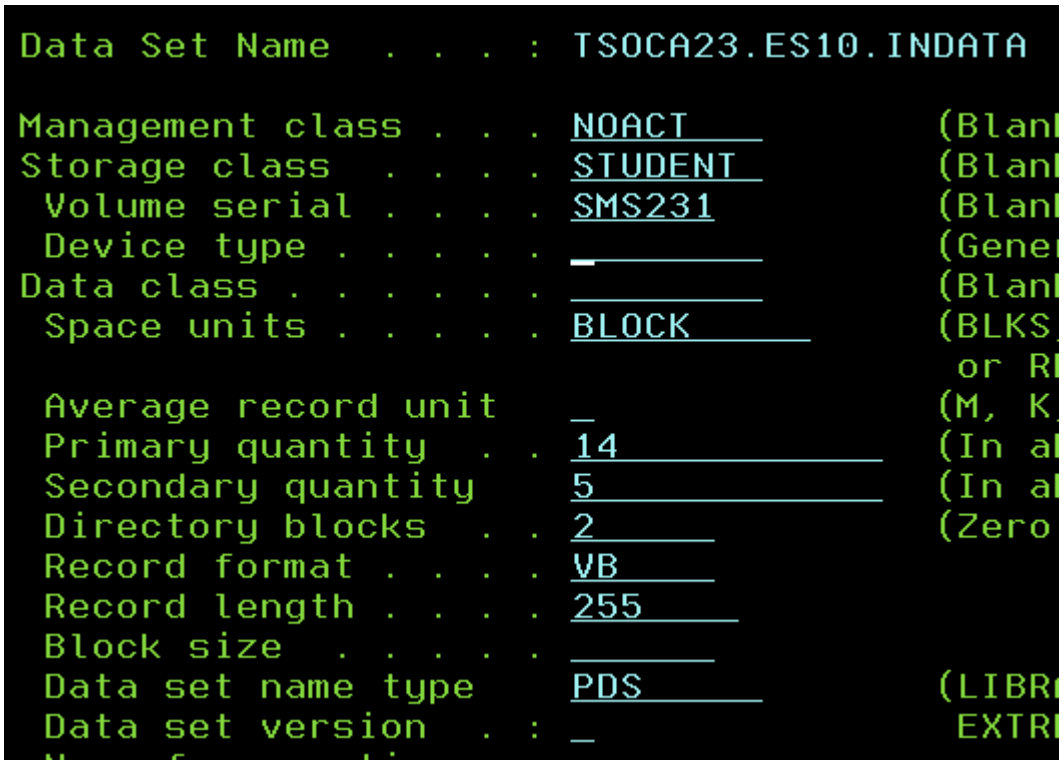
__ 3. Allocate a new data sets called ***userid*.ES10.INDATA**:

Type a (allocate) on the command line (do not press Enter yet).

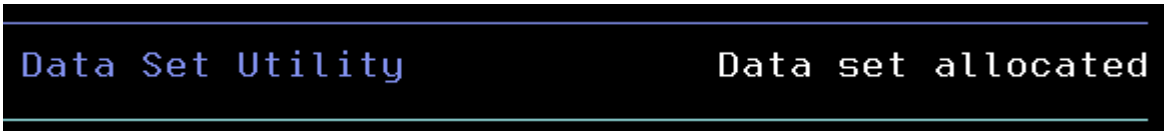
Type INDATA next to Type under ISPF Library (Project and Group should already have **your userid** and **ES10**):



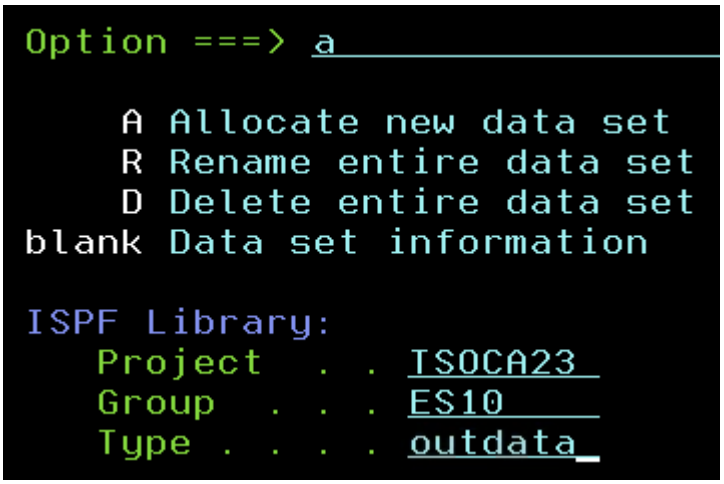
Press Enter. This will show the Allocate New Data Set panel with the proposed data set attributes, which are copied from **userid.ES10.PDS** (the last data set ISPF displayed):)



Press Enter to accept the displayed attributes and allocate (create) the data set. This returns to the Data Set Utility panel and shows the confirmation message “Data set allocated”.



__ 4. Allocate a new data set called ***userid*.ES10.OUTDATA**. You know this: repeat the previous step, but this time **enter OUTDATA** in ISPF Library Type:



Create and edit a new member

You will now create a new member called **A** in ***userid*.ES10.INDATA**, and enter some test data into it.

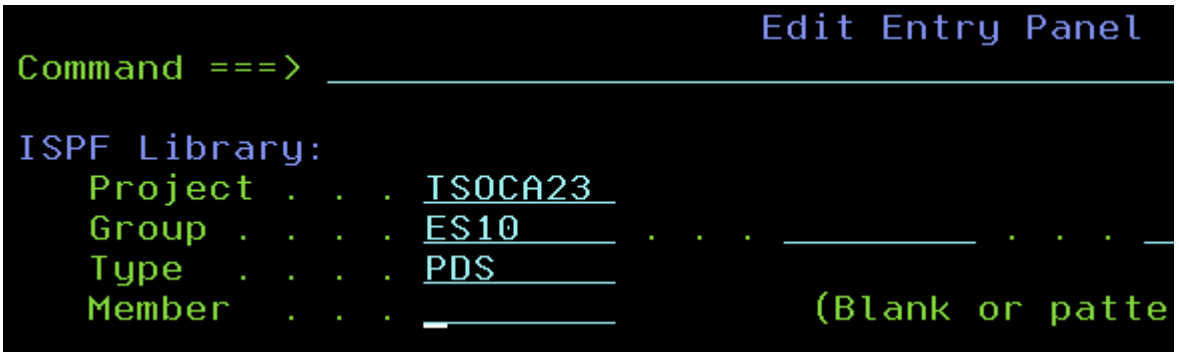
You can enter your coworkers names, your family names, etc.

__ 5. The easiest way to create a new member called **A** in ***userid*.ES10.INDATA** is to use the Editor.

After allocating ***userid*.ES10.OUTDATA**, you'll be back on the Data Set Utility panel.

Enter **=2** on the command line to go to Edit:

This will display the Edit Entry Panel:



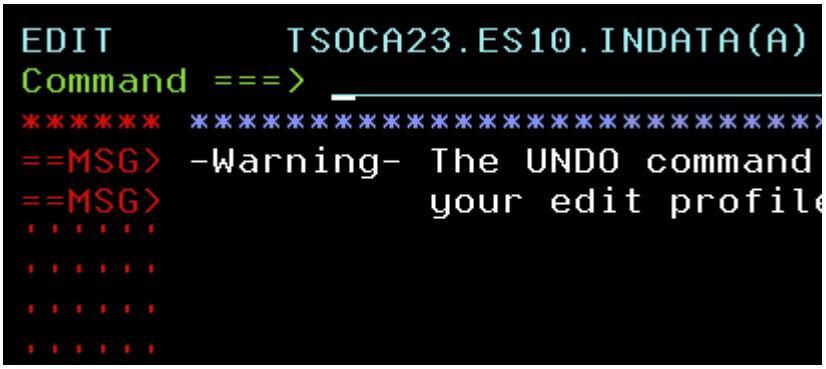
Note that the data set displayed under ISPF Library may not be the one you want (***userid*.ES10.INDATA**).

__ 6. Make sure that ISPF Library contains:

Project: your userid.
Group: **ES10**.
Type: **INDATA** (The other two will probably be already there, this one you have to enter.)
Member: **A**.

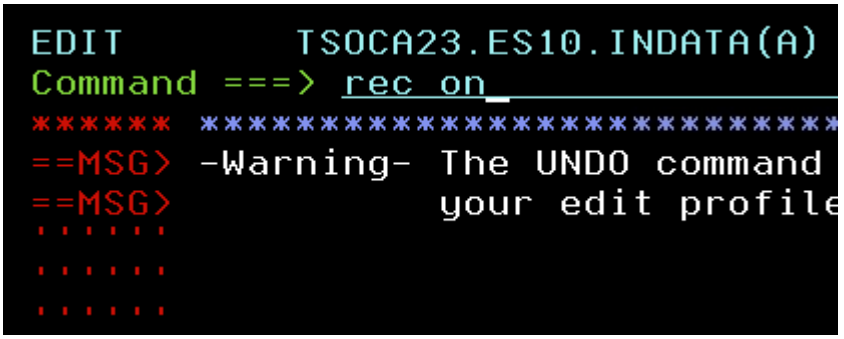
The panel should look like this (again, *TSOCA23 is an example; enter your userid instead*):

Press Enter to open the editor. This will show the empty member called A:

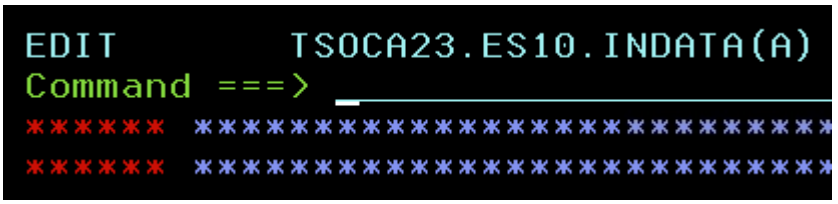


Note the warning message about UNDO. This is because this is the first time you edit this data set (not a surprise, as we just created it).

__ 7. **Enter REC ON** (RECOVERY ON) to enable UNDO and remove the warning message:

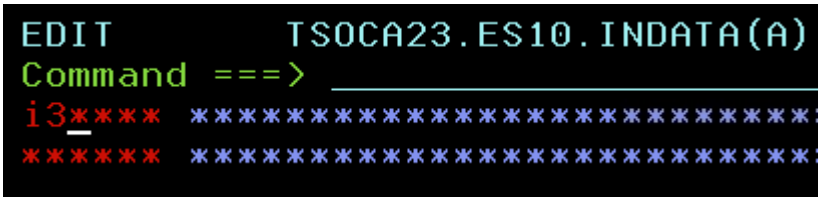


Press Enter. You should see:

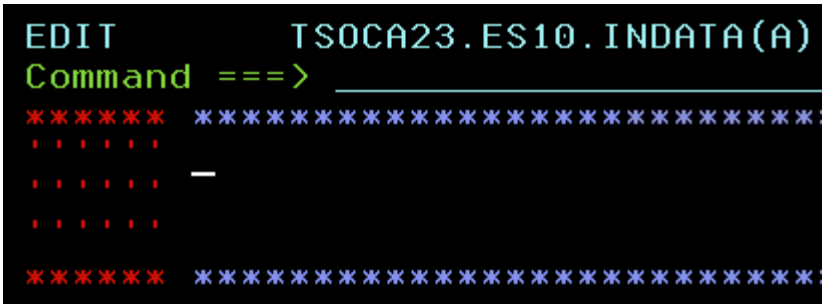


__ 8. We'll now insert three names in member A.

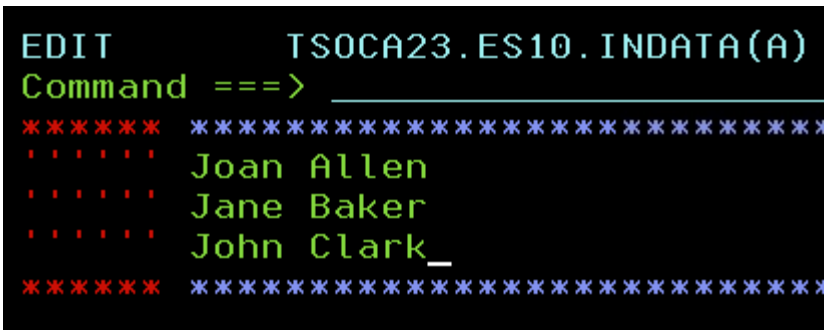
Type I3 (insert 3 lines) in the top prefix:



Press Enter. Three empty lines appear:



__ 9. **Press Tab** to place the cursor in each line and enter random text on the three lines. For example, three names:



__ 10. **Press F3** (END) to save the member to disk and close the editor.

You'll be back to the Edit Entry Panel. You should see a "Member A saved" confirmation message:

Create nine new members

Your next task is to create nine new members called **B** through **J** which contain the same data as member **A**.

There are three ways to do this: the CREATE Edit command, the COPY Edit command, and the Copy Utility.

We will do the following:

- Create member B using the CREATE edit command.
- Create member C using the COPY edit command.
- Create member D using the Copy Utility.

You will then create members E through J using the method you like best.

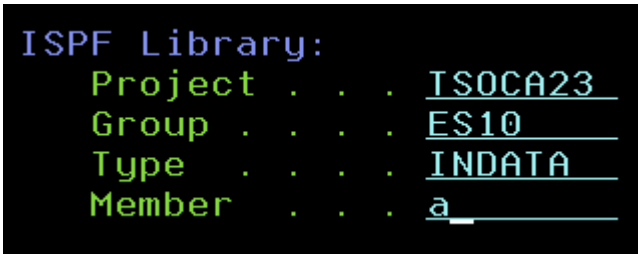
Let's start by creating member B using the CREATE edit command.

__ 11. Open member A of ***userid*.ES10.INDATA** in the editor.

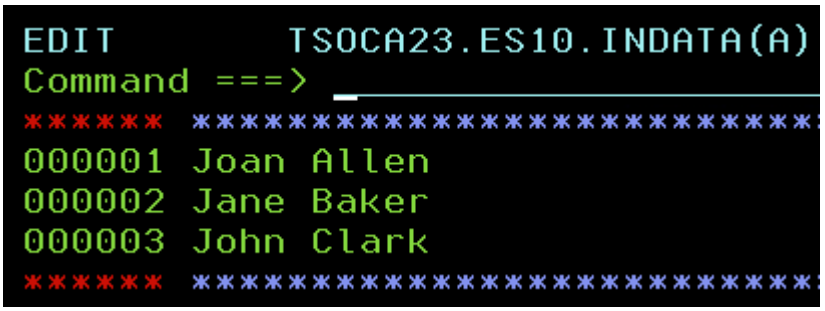
If not already in the Edit Entry Panel, enter **=2** from wherever you are to get there. You should see:

If Project, Group, or Type are not as above, Tab to the fields and enter the correct values (**your userid**, **ES10**, and **INDATA**).

Tab to Member and **Enter A**:



Press Enter. This will open member A in the editor and show the lines you entered before:



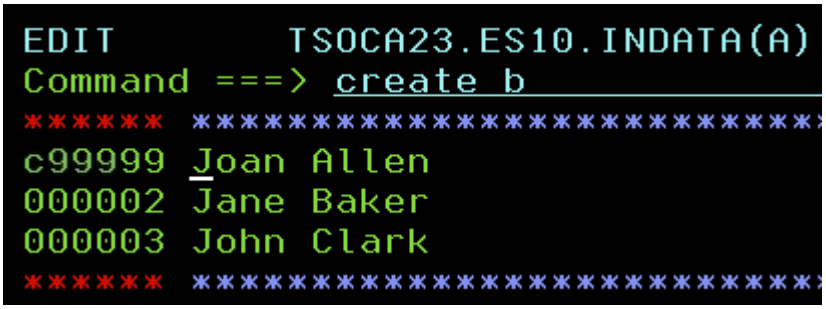
__ 12. To create member B with the same contents as A:

Enter **CREATE B** in the command line (do not press Enter yet).

This tells the editor to create a member called B.

Enter C99999 in the line 1 prefix.

This tells the editor to copy all the lines in A to B.



Note

C99999 means “copy 999999 lines from here”. Bit of an overkill, but this is a good way to say “copy all the lines from here”.

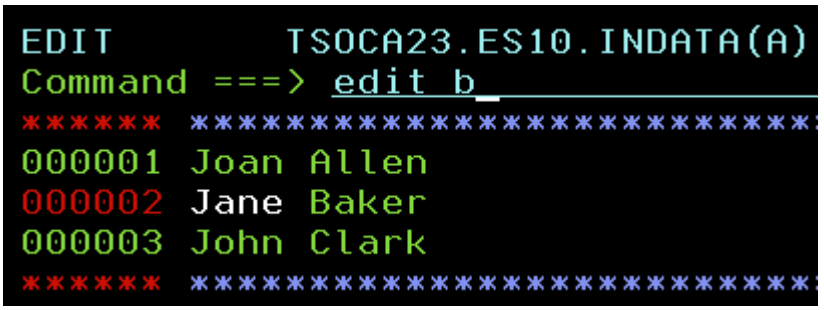
You could have also entered “C3” (copy 3 lines).

If you enter “C1”, or just “C” on a line, member B will contain just that line.

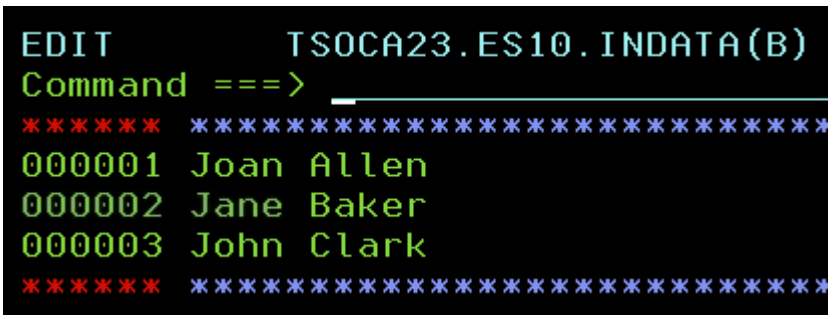
Press Enter. You should receive the confirmation message “Member B created”:

Wait a minute! How do we know that member B has the expected contents? OK, if you don't believe us, try this:

__ 13. **Enter EDIT B** on the command line to open B in the editor:

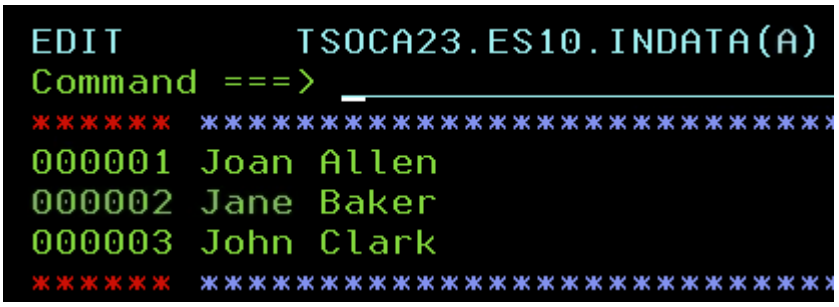


Press Enter. This will show:



Note the first line: the member being edited is B, and it has the same contents as A. Happy?

__ 14. **Press F3** to close B and return to A:



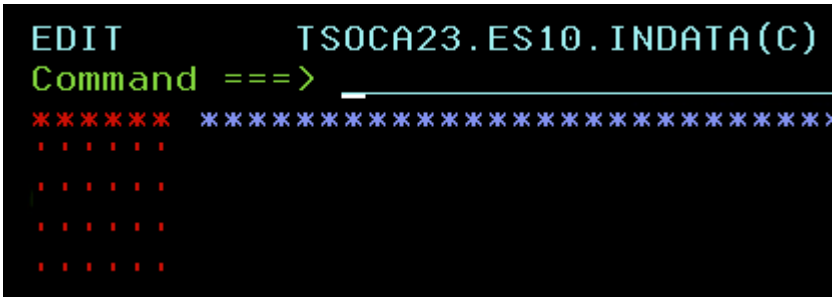
__ 15. **Press F3** again to go back to the Edit Entry panel (we need that panel to create member C using the other method).

If all goes to plan, you're now here:

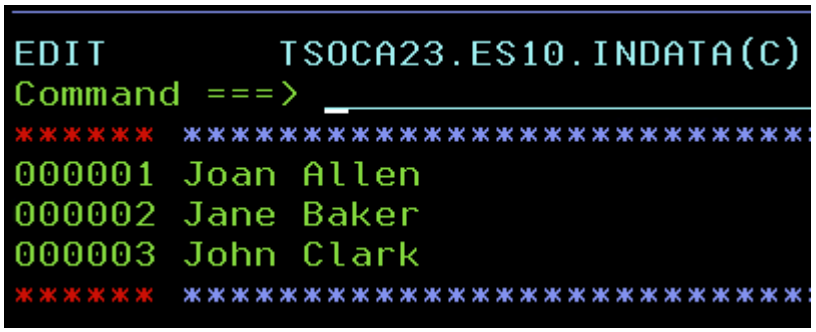
__ 16. One down, two to go. Now we'll create member C using the COPY edit command.

Tab to Member and **Enter C**:

Press Enter. This opens the empty C member in the editor:



__ 17. **Enter COPY A** in the command line, then **press Enter.** This will copy all the lines from A to C and show:

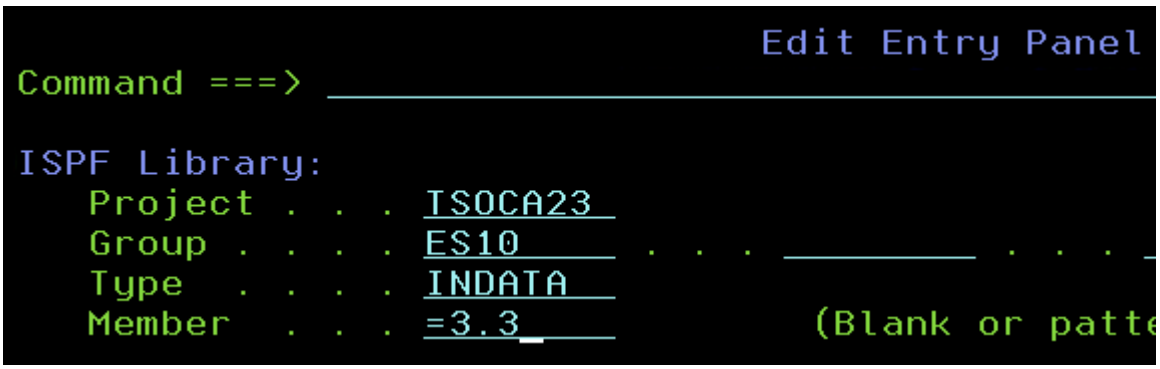


Success! **Press F3** to save member C and exit the editor. You should be back to the Edit Entry panel and have the “Member C saved” confirmation message:

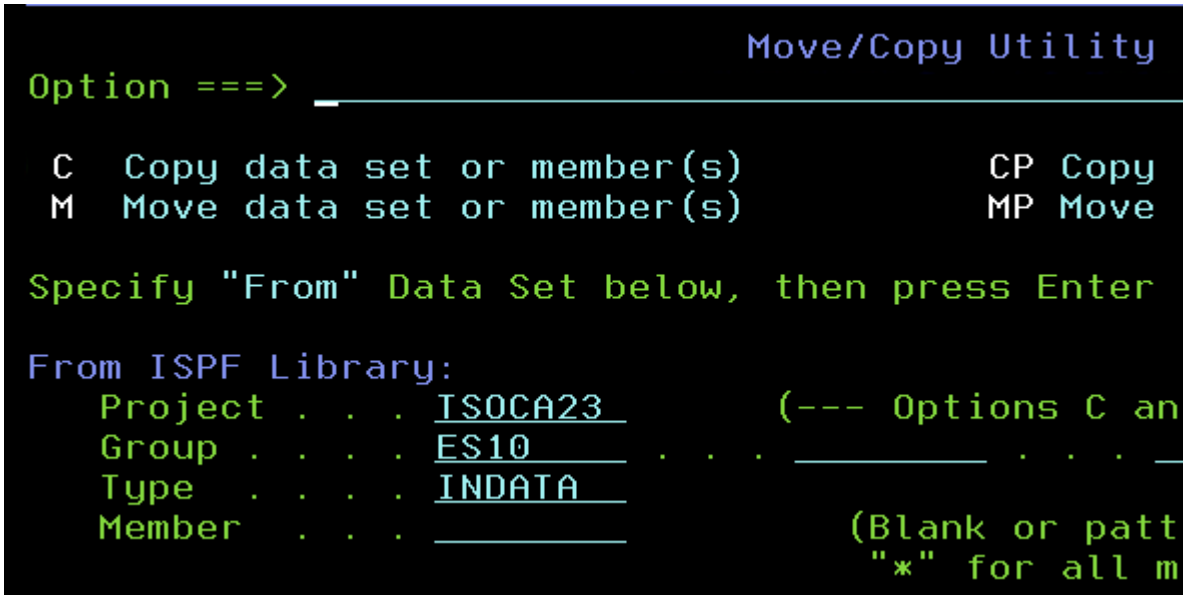
__ 18. Our third (and last) method is the **Copy Utility**.

To go to the Copy Utility you can enter 3 (Utilities) on the Main Menu, then 3 again (Move/Copy).

We’ll go directly to the Move/Copy Utility panel by entering **=3.3** from where we’re now, the Edit Entry panel:



This will take directly to:



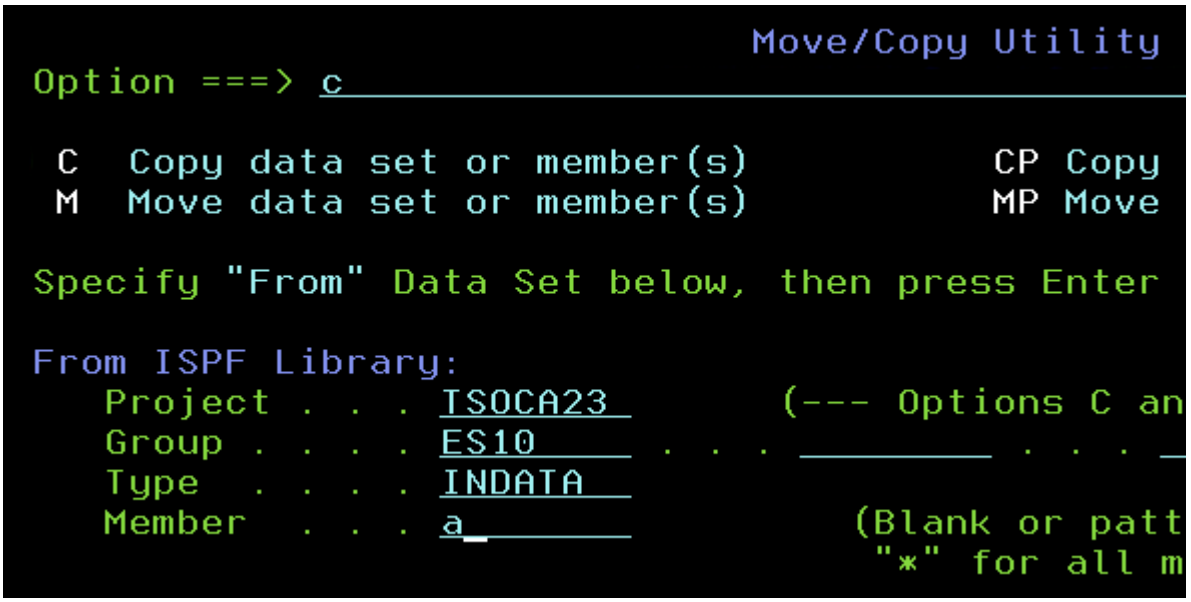
On the left, you have two options that you can enter on the command line: C (copy) or M (move).

Next, you have the “From ISPF Library” fields, where, as the name suggests, you select the data you are copying from.

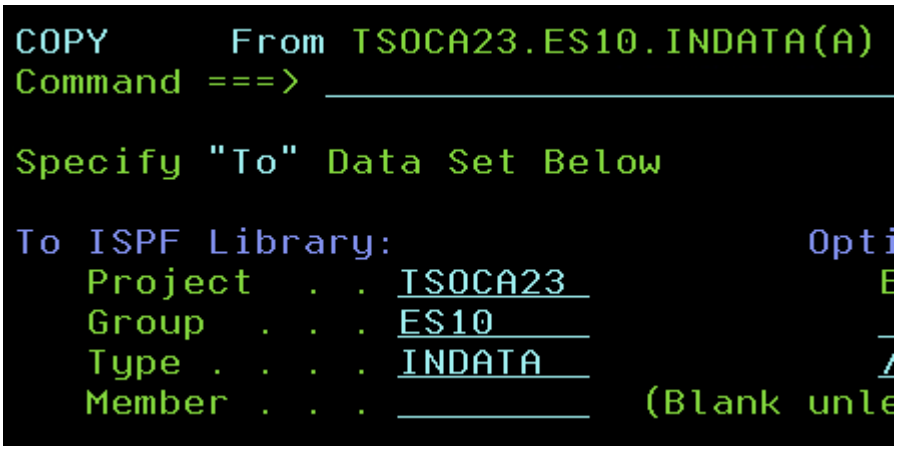
__ 19. We’ll copy member A to member D. As member D doesn’t exist, it will be created.

Enter C in the command line (do not press Enter yet).

Tab to Member and **enter A**:

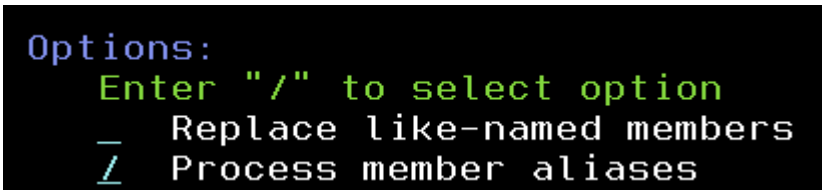


Press Enter. This will open the panel to specify the “Copy/Move To” data set or member:



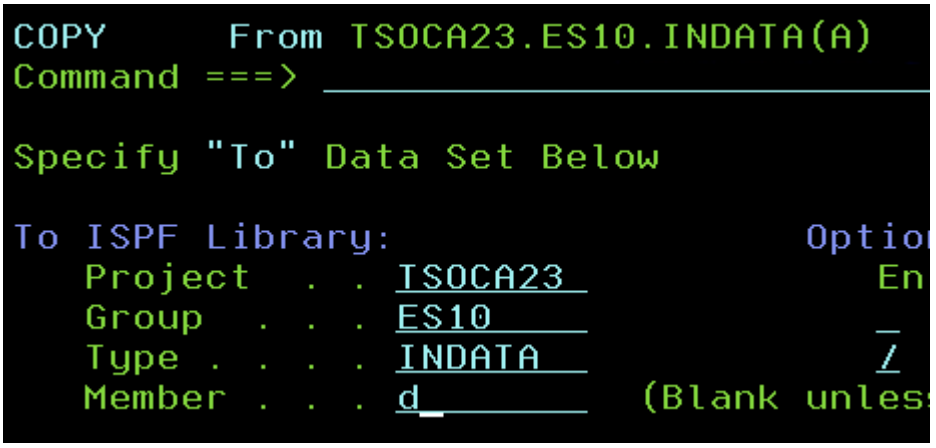
Note the first line: we’re copying from **‘userid.ES10.INDATA(A)’**.

Below you can specify where you want to copy A to. So far we created members B and C, we will now create member D. Before we do that, a look at the options to the right of the panel:



Note the “Replace like-named members” option. In this case, the member we copy to (D) doesn’t exist, so we can ignore it. If we were copying from A to (say) B, which does exist, we would have to enter “/” to specify that B is replaced, otherwise the copy will not go ahead.

__ 20. **Tab to Member** and **enter D**:



Press Enter. This will copy A to D (and also create D). You’ll be back to the Copy/Move Utility panel and should see a “Member A copied” confirmation message:

Information

Not convinced? Need more details? You can **press F1** to get more information about the “Member A copied” message.

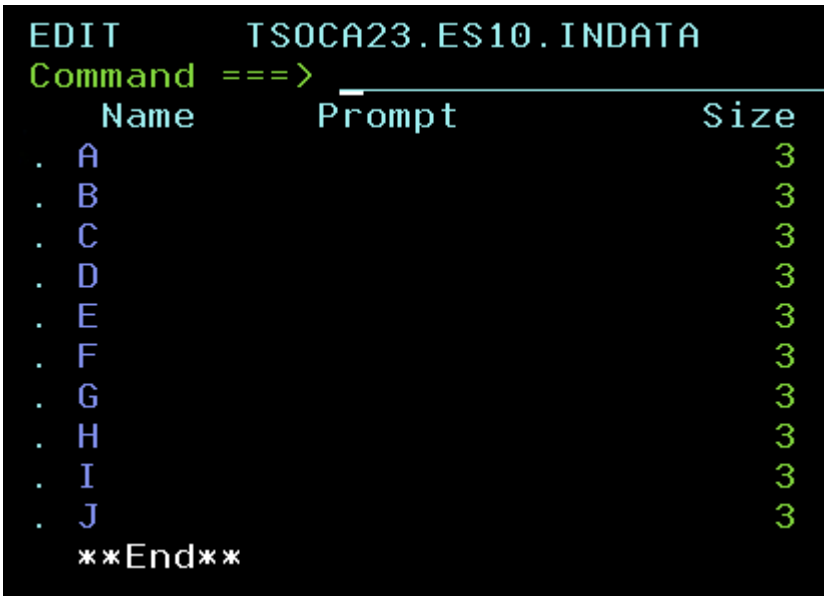
If you press F1 when a confirmation message appears at the top right-hand corner, you will see extra information about that message. In this case, after pressing F1, you’ll see this at the bottom of the panel...

...confirming that member A was copied to member D.

__ 21. Now that you’ve seen the three possible ways of creating new members with the same contents as member A, **use the method you liked best/found easier to create members E to J**.

When you’re done creating all the members, do this to verify that everything went OK. Go to the Edit Entry panel (enter **=2** from any panel):

Leave the Member field empty and **press Enter**. This will open the data set member list:

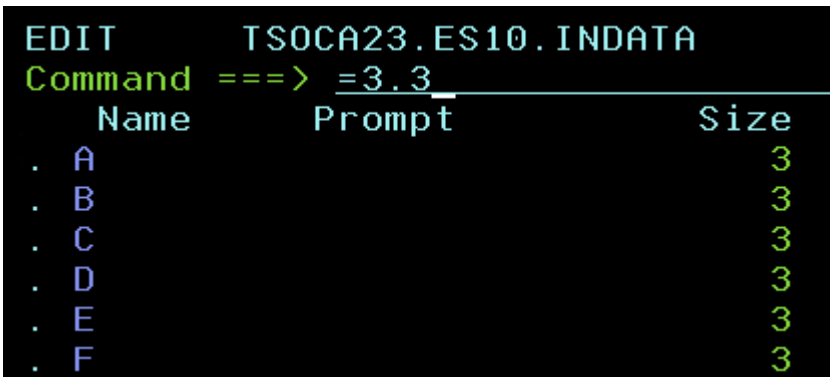


As you can see, there are 10 members, names A to J, all of them with 3 records.

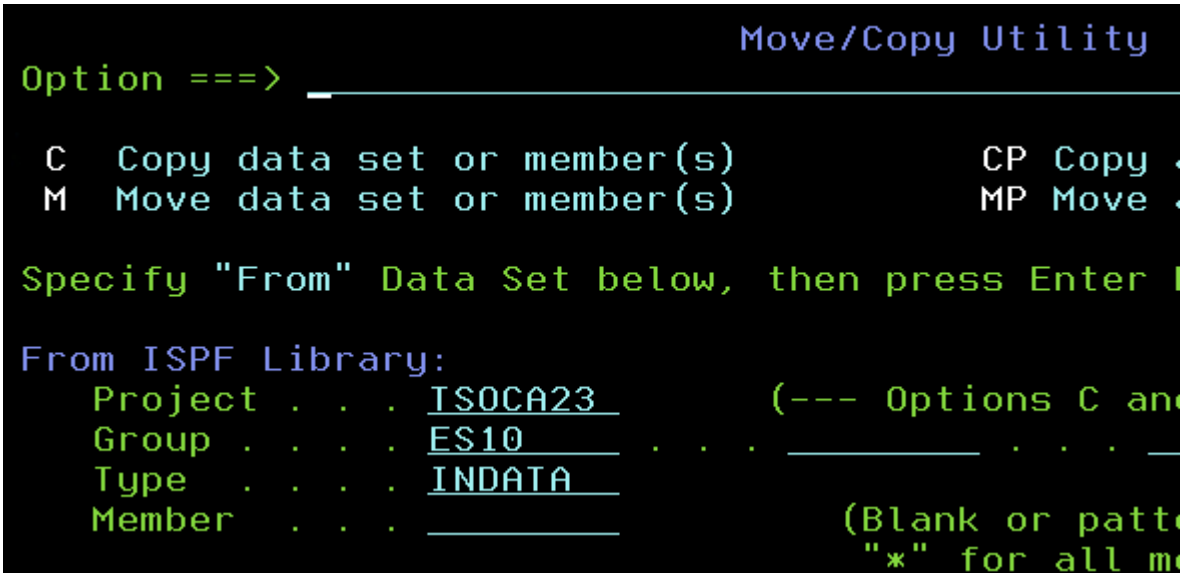
Copy all members to another data set

Now we'll copy the entire data set ***userid*.ES10.INDATA** into ***userid*.ES10.OUTDATA**.

__ 22. **Enter =3.3** from any panel to go to the Copy/Move Utility panel. For example, if you still are on the previous panel:



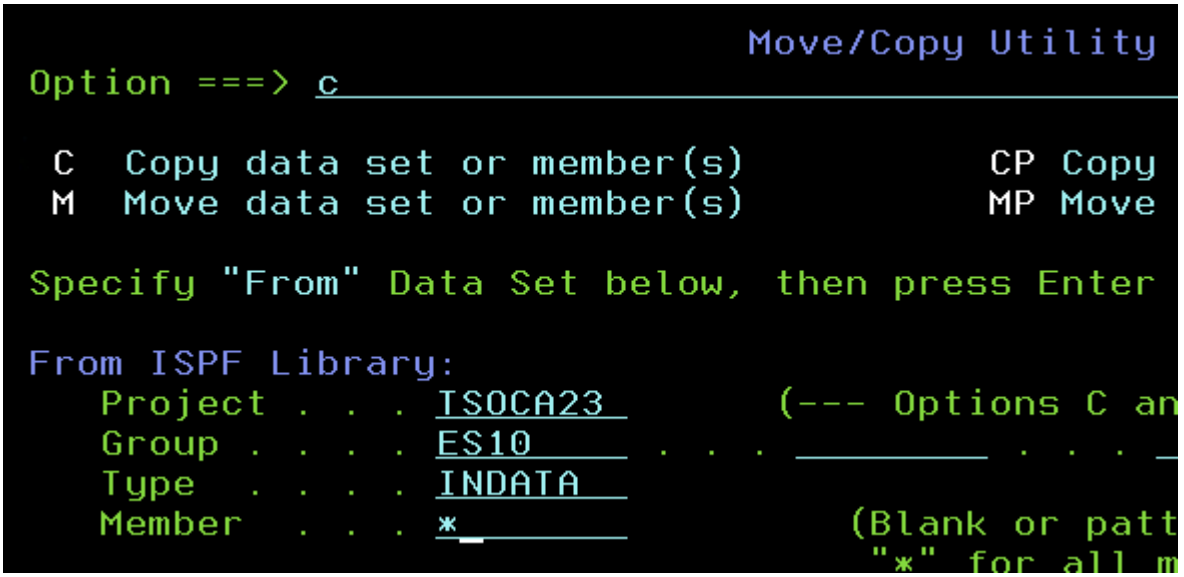
Press Enter. This takes you to:



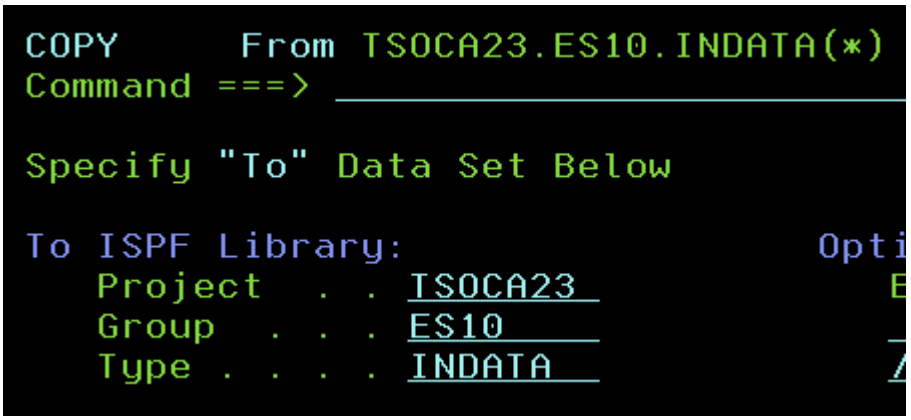
Note we already have the correct “From” data set, ***userid*.ES10.INDATA**.

__ 23. **Enter C** (Copy)in the command line (do not press Enter yet).

We want to copy the entire data set. This means copying all the members. To do that, **tab to Member** and **enter *** (asterisk means “all members”):

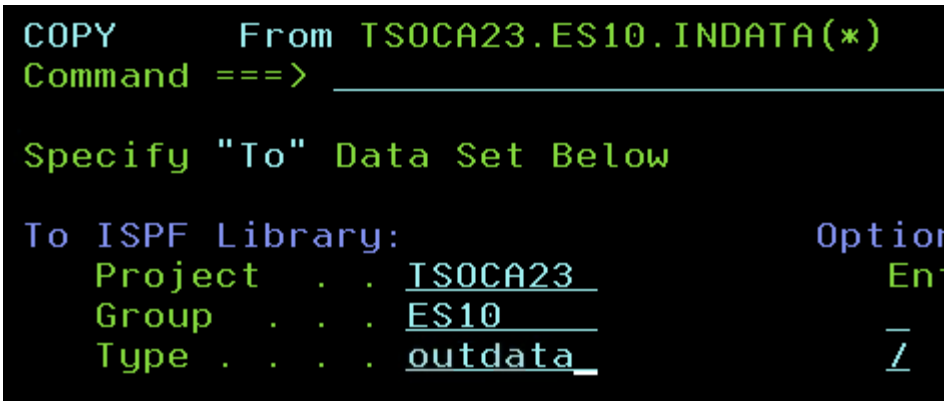


Press Enter. This will open the panel to select the “To” data set:



Note the “To” data set is the same as “From”. We need to change it.

__ 24. **Tab to Type** and **enter OUTDATA**:



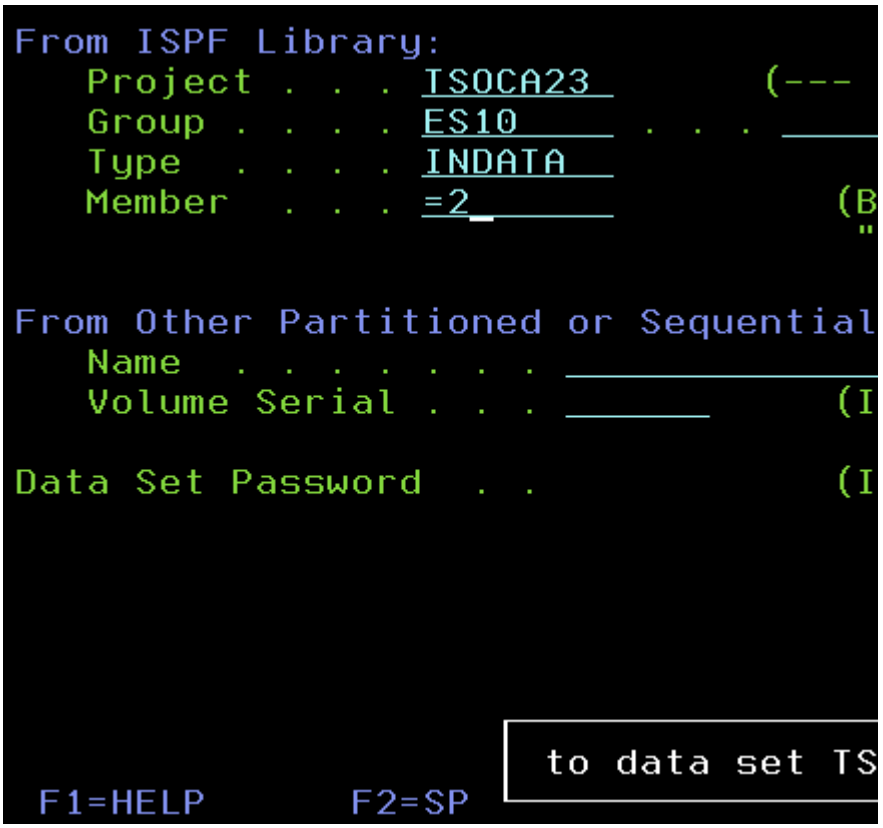
Press Enter. This will copy all the members in ***userid*.ES10.INDATA** to ***userid*.ES10.OUTDATA.**

You’ll be back to the Copy/Move Utility panel and should see a confirmation message (“10 members copied”):

Press F1 to get more information about the message. You should see this at the bottom of the panel:

__ 25. Change the contents of members **D** and **H** in ***userid*.ES10.INDATA.**

Enter =2 in the current panel to go to the Editor:



Press Enter to open the Edit Entry panel.

Note

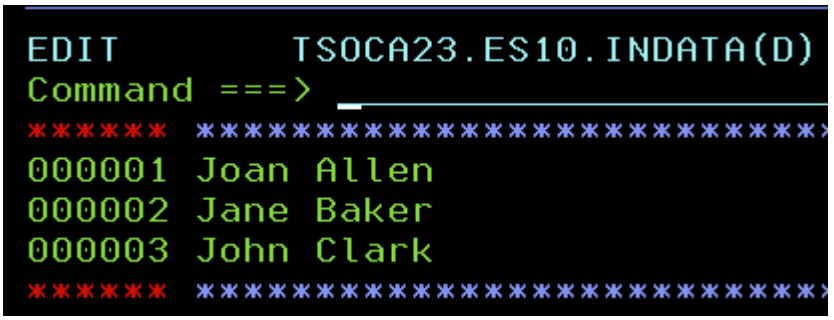
As you can see, you can enter “=2” (or any other option) in fields other than the command line.

Not all fields, though. If you want to be safe, always enter =2, =3.3... in the command line.

__ 26. We'll start by changing member D. On the Edit Entry panel, tab to Member and **enter D**:

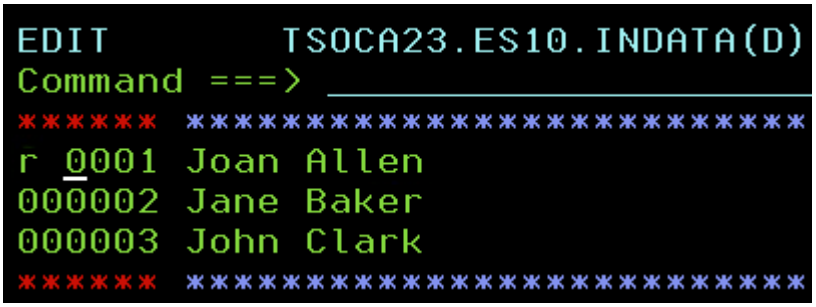
If the data set under ISPF Library is not ***userid*.ES10.INDATA**, tab to the fields and make the necessary changes.

Press Enter. This opens member D in the editor:



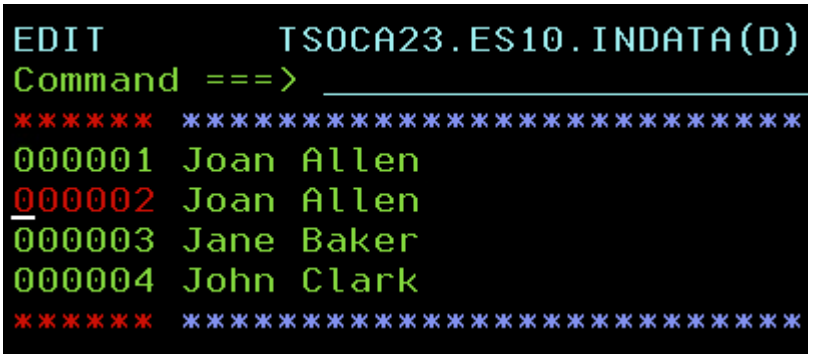
__ 27. Now we'll make a change. We'll repeat the first line.

Tab to the line 1 prefix and **type R**:



Note that, although not strictly necessary, we type a space after R, as Jeff suggests in the video.

Press Enter:



__ 28. **Enter SAVE** in the command line and **press Enter**:

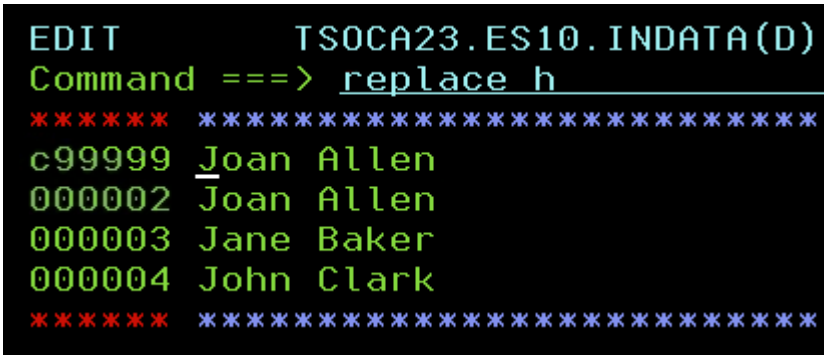
We have changed member D. Now we want to change member H.

One way to do this is to use the editor copy member D to member H, but how? We cannot use CREATE as last time, as member H now exists and cannot be created.

Not a problem, we can use the REPLACE edit command. Let's see how that works.

__ 29. On the editor **command line**, **type REPLACE H** (do not press Enter yet).

On the **Line 1 prefix area**, type **C99999**, as before (C4, or even C99 will do, if you prefer):



Press Enter. You should see the "Member H replaced" confirmation message:

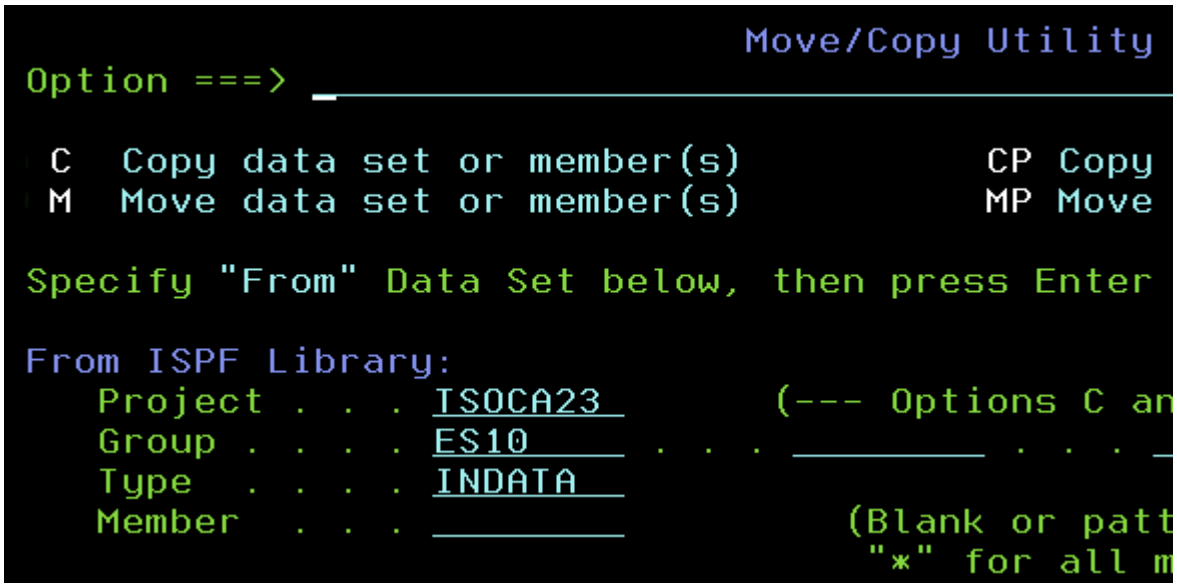
(Feel free to enter **EDIT H** to double check if you don't believe us. Remember to **press F3** to close H afterwards.)

Press F3 to close the Editor.

__ 30. Now that we changed the contents of members **D** and **H** in ***userid*.ES10.INDATA,** we want to copy them again to ***userid*.ES10.OUTDATA**.

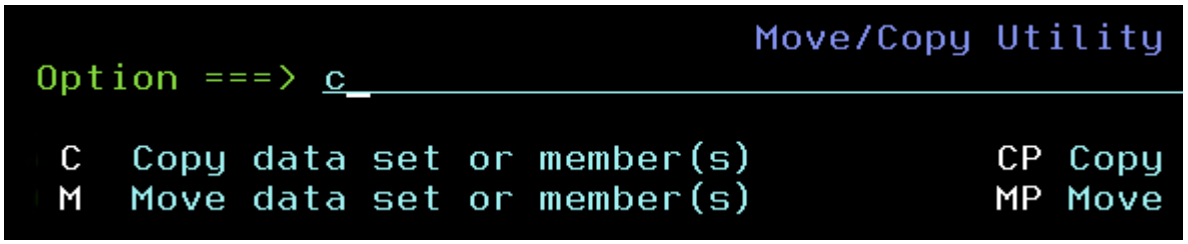
This time members D and H exist in ***userid*.ES10.OUTDATA**, so *we'll need to use the Replace option.*

Enter **=3.3** and **press Enter** to go to the Copy/Move Utility panel:

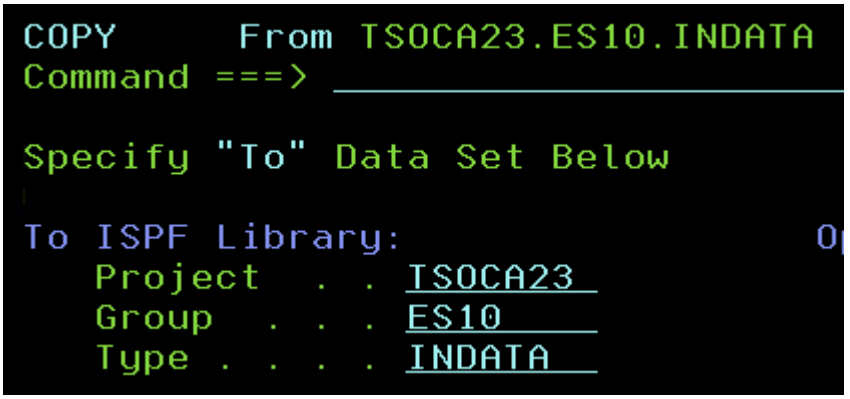


"From ISPF Library" should already point to **userid.ES10.INDATA**. Change it to **userid.ES10.INDATA** if not.

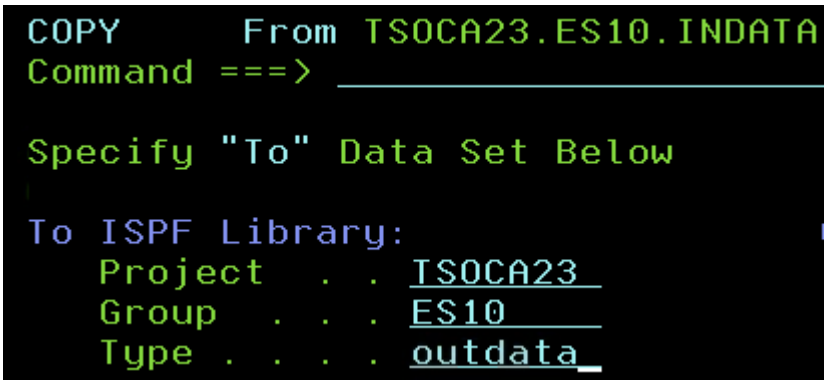
__ 31. **Enter C** (Copy) in the command line (**leave the Member field empty**):



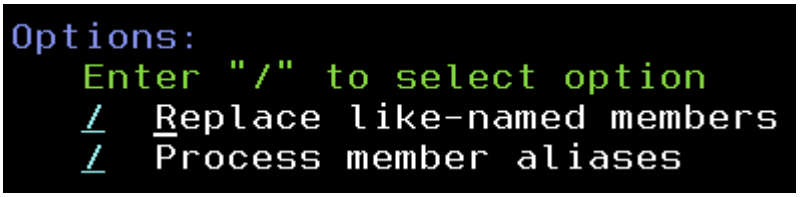
Press Enter. This opens the “To” selection panel:



__ 32. As before, we’ll need to **tab to Type** and change INDATA to **OUTDATA**:

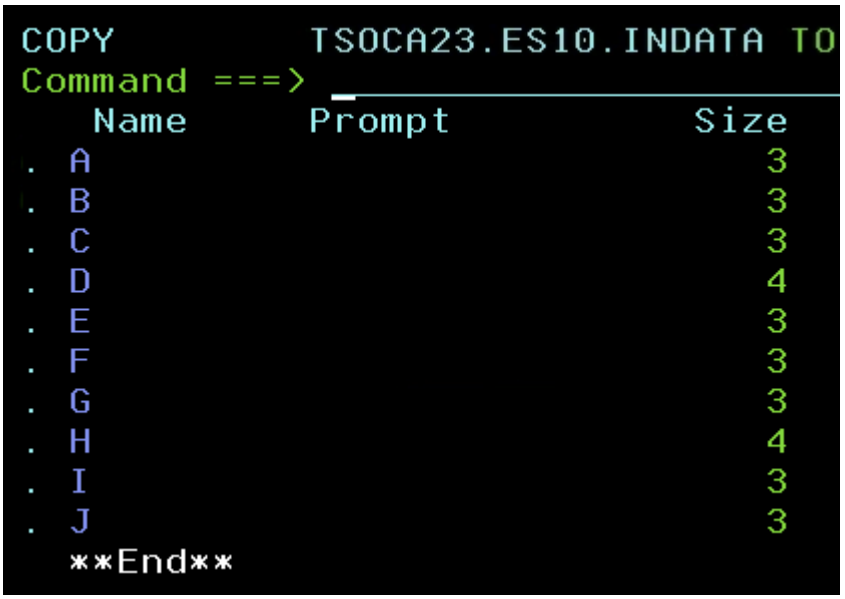


__ 33. Check the options to the right of the panel. Members D and H exist on ***userid*.ES10.OUTDATA**; we want to replace them. **Tab to Replace like-named members** and **enter a slash ("/")**:



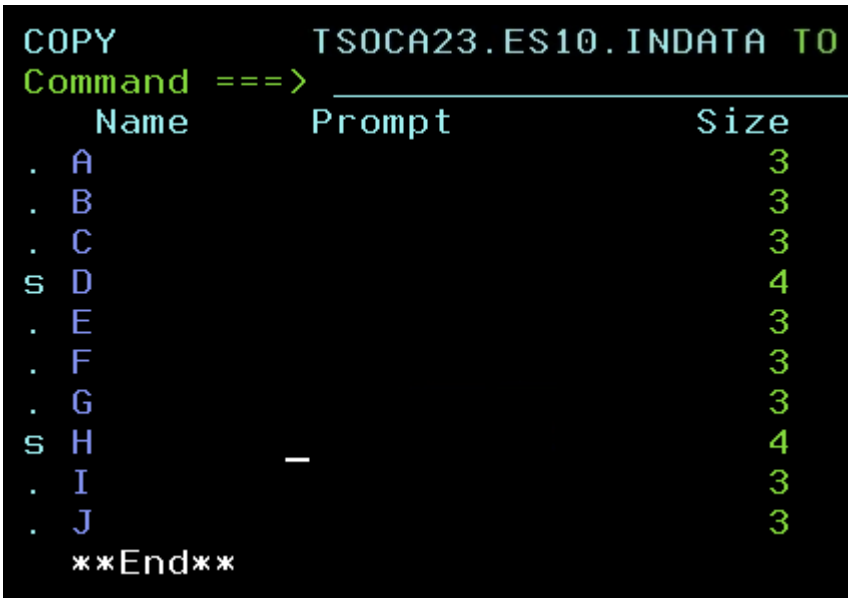
Press Enter.

__ 34. Because we didn't enter a member name in the "From" data set, ISPF shows us the list of all members in ***userid*.ES10.INDATA**:

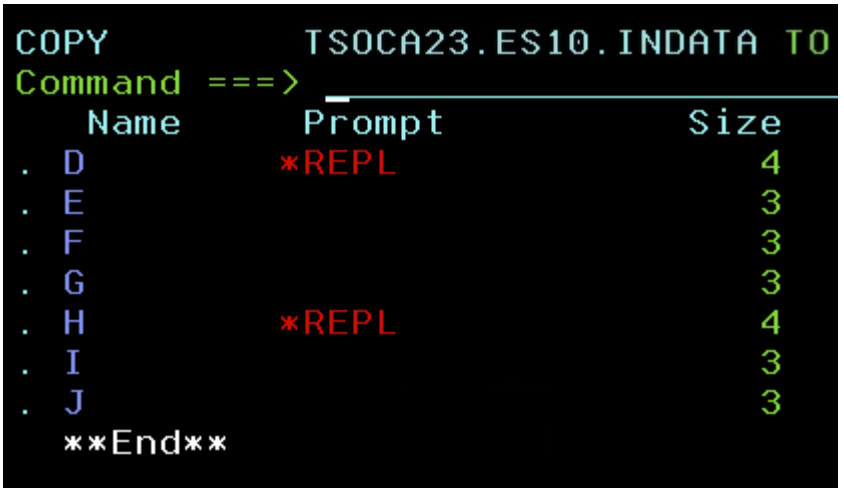


As you see, all the members have 3 records, except D and H, which have 4. Those are the changed members we want to copy.

__ 35. **Tab to D** and **enter S** (Select), then **tab to H** and **enter S**:



Press Enter. This copies the two selected members. You should see this:



Note "***REPL**" next to D and H, confirming they have been replaced.

__ 36. Verify whether the members **D** and **H** have been copied correctly by editing or viewing them.

You know how to do this by now, so we won't go into more detail.

Deleting and renaming members and data sets

We reached the last part of this lab, where you'll perform these tasks:

- Delete ***userid*.ES10.INDATA**.
- Rename ***userid*.ES10.OUTDATA** to ***userid*.ES10.DATA**.
- Delete all members in ***userid*.ES10.DATA** except members **A**, **D**, and **H**.
- Rename these members to **DATA1**, **DATA2**, and **DATA3**, respectively.
- Move members **DATA1** and **DATA3** to ***userid*.ES10.PDS**.
- Delete ***userid*.ES10.TEXT** and ***userid*.ES10.PDSE**.

As you know the basics by now, in this section we'll provide general hints instead of detailed instructions.

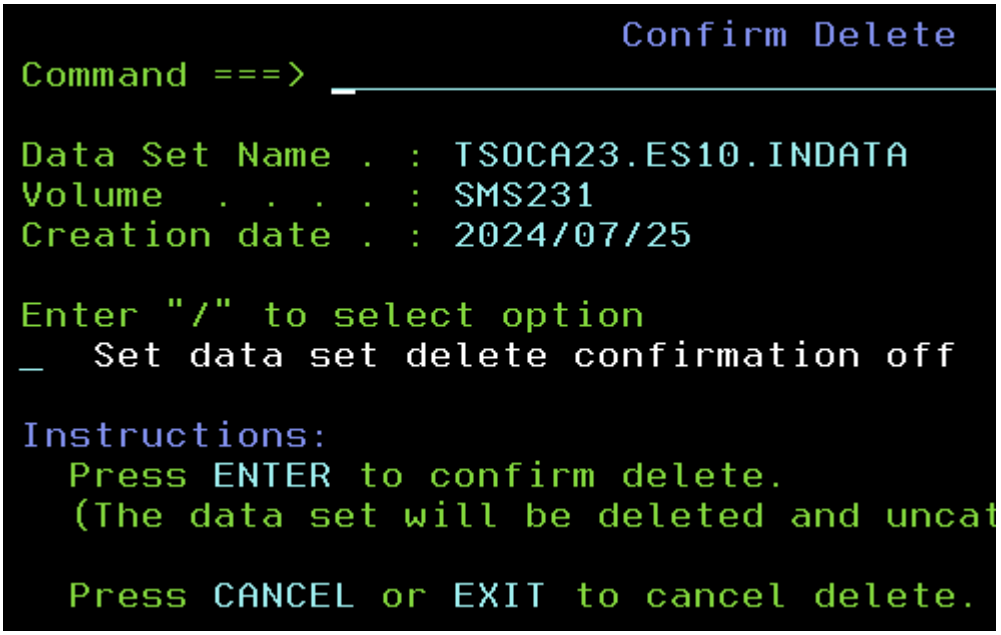
Let's get going!

__ 37. Delete ***userid*.ES10.INDATA**.

To do this, enter **3.2** from the ISPF Main Menu (or **=3.2** from any panel) to open the Data Set Utility panel.

Enter D (delete) on the command line, enter **your userid, ES10 and INDATA** in ISPF Library, then **press Enter**.

This confirmation panel appears:



Press Enter to delete the data set. You'll be back to the previous panel and will see the "Data set deleted" confirmation message.

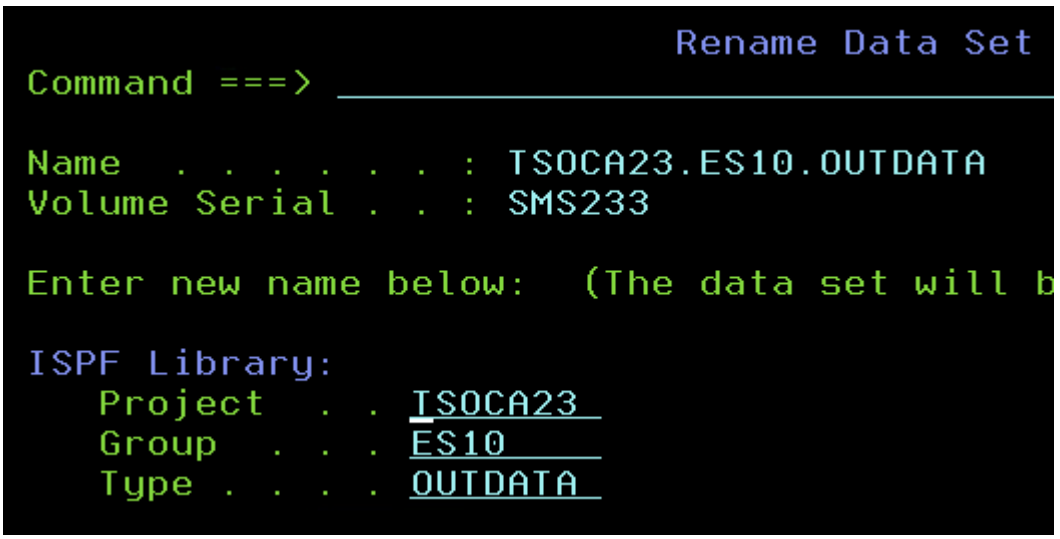
If you change your mind and do not want to delete the data set, you can **press F3**, **enter CANCEL** on the command line, or **enter EXIT** on the command line, to return to the previous panel without deleting the data set.

__ 38. Rename ***userid*.ES10.OUTDATA** to ***userid*.ES10.DATA**.

You're back on the Data Set Utility panel after deleting ***userid*.ES10.INDATA** in the last step (if you're not, **enter =3.2** to get there).

Enter R (rename) on the command line, enter **your userid, ES10, and OUTDATA** in ISPF Library, then **press Enter**.

The Rename Data Set panel appears:



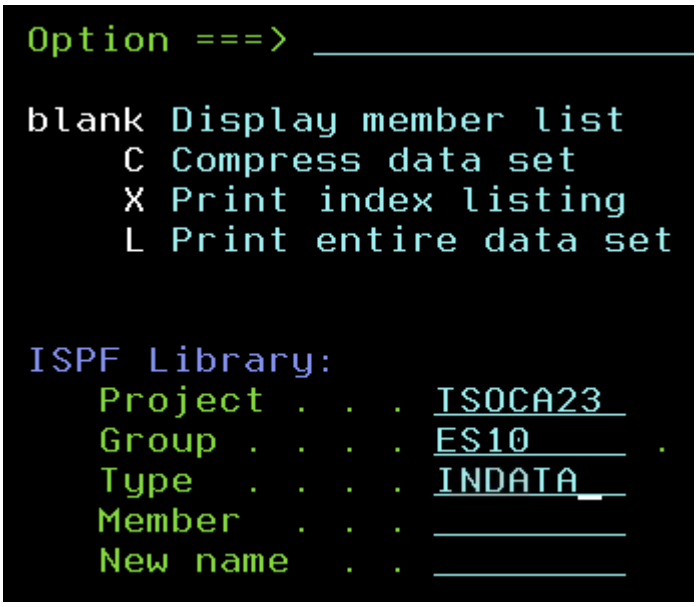
Change Type from OUTDATA to DATA and **press Enter**. You'll be back to the previous panel and will see the "Data set renamed" confirmation message.

__ 39. Delete all members in ***userid*.ES10.DATA** except members **A**, **D**, and **H**.

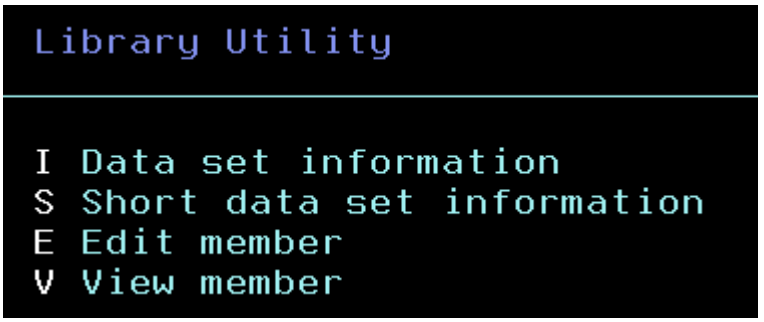
To do this, you will use the Library Utility: from the Main Menu, this is option 3 (utilities) then option 1 (library).

Enter 3.1 on the Main Menu or **=3.1** on any panel to open the Library Utility panel. To fit all the information to the page, we'll split the screenshot in three parts. This is the left side of the panel, where you see which options you can enter on the command line and, below,

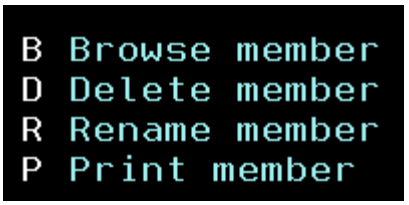
the usual ISPF Library fields.:



This is the center, showing more options (note you can, for example, edit a member from here):



More options to the right of the panel:



This utility is for working with members in a PDS or PDSE. Although we can delete one

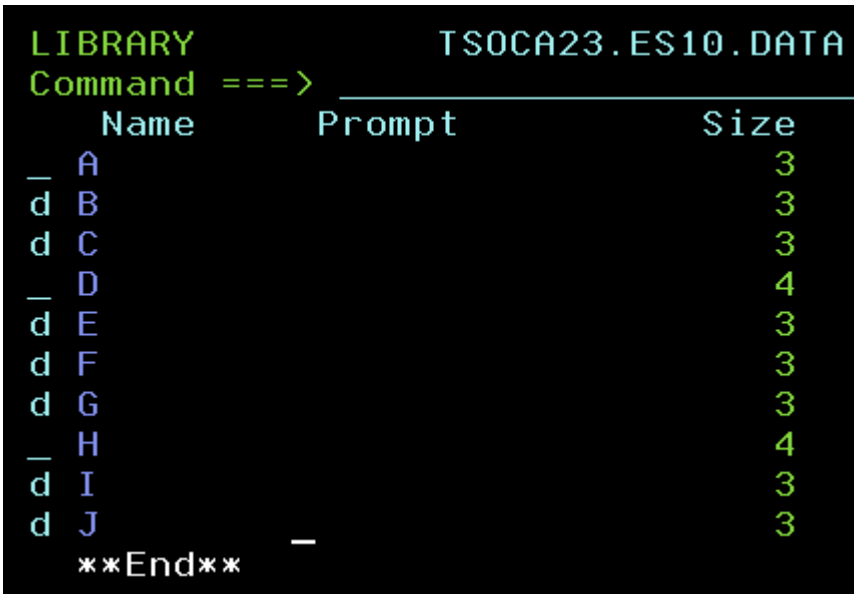
member at a time using the D (delete) option, we'll do it from the member list.

Leave the command line blank (Display the member list option).

Under ISPF Library, enter ***your userid*, ES10, and DATA.**

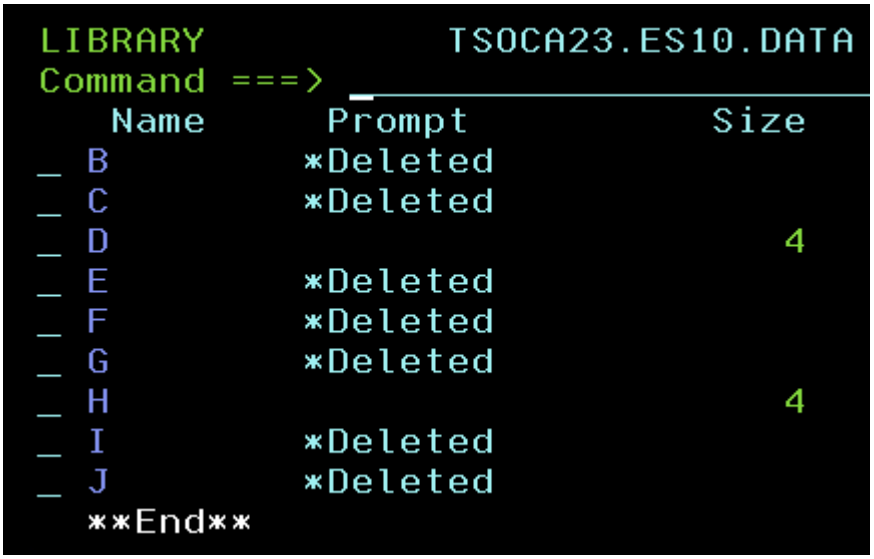
Press Enter. This will show a panel listing all the members in ***userid*.ES10.DATA**.

Enter D (delete) next to all the members, except **A**, **D**, and **H** (use tab to place the cursor next to each member):



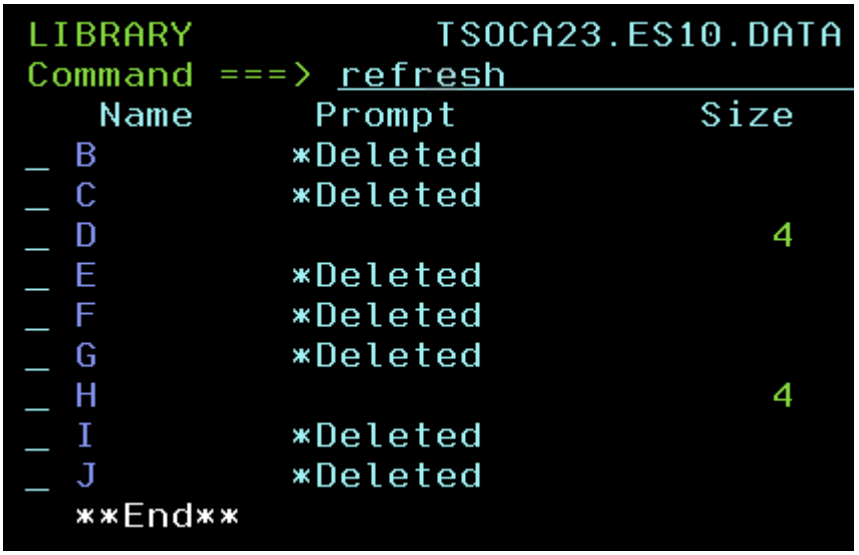
Press Enter. This will open a confirmation panel. For each member, **press Enter again** to

confirm deletion. You can also enter a slash (“/”) next to “Set member delete confirmation off” if you prefer (but it may be safer to keep confirmation on). After all members are deleted, you will see:

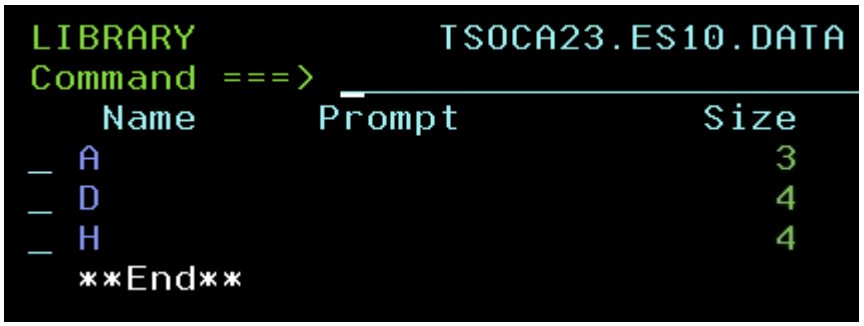


__ 40. Rename members **A**, **D** and **H** to **DATA1**, **DATA2**, and **DATA3**, respectively.

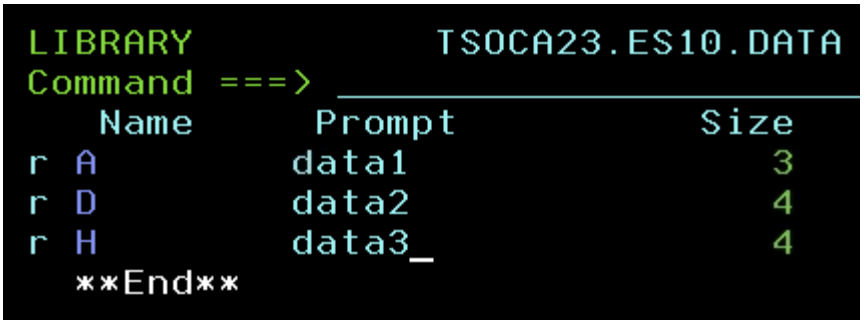
Note that member A doesn’t show on the screenshot above, as ISPF automatically scrolls to the first deleted member. **Enter REFRESH** on the command line:



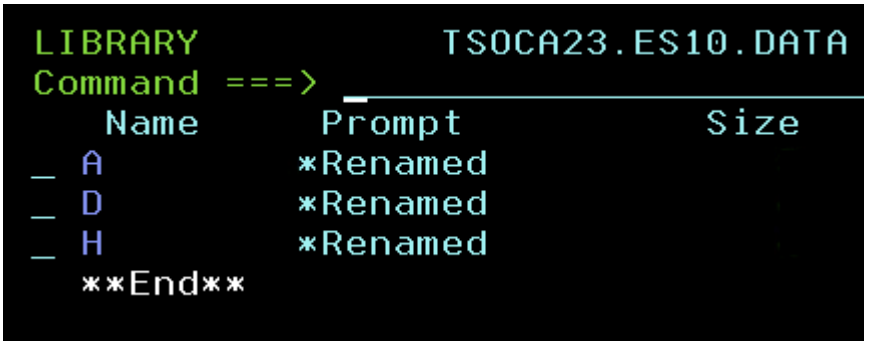
This will show the updated member list:



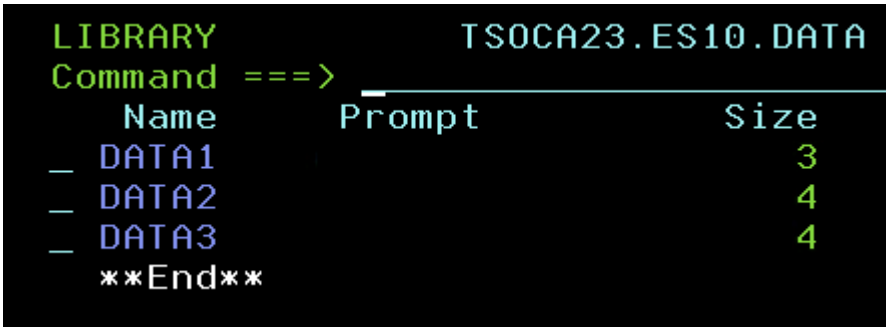
Enter R to the left of each member, and **DATA1, DATA2, and DATA3** to the right:



Press Enter. The panel will show “*Renamed” next to each member:

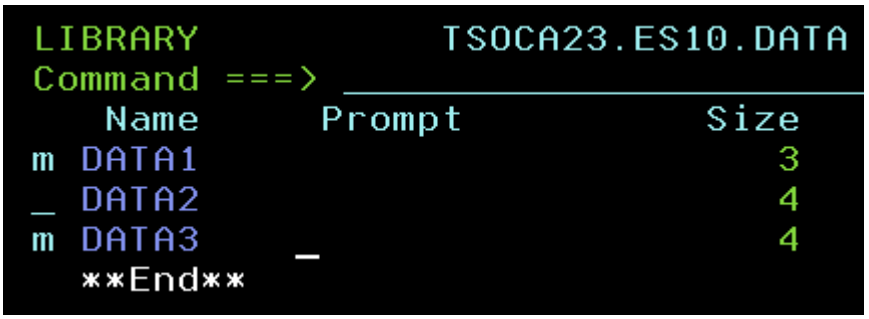


Enter REFRESH on the command line. This refreshed panel will show the new member names:

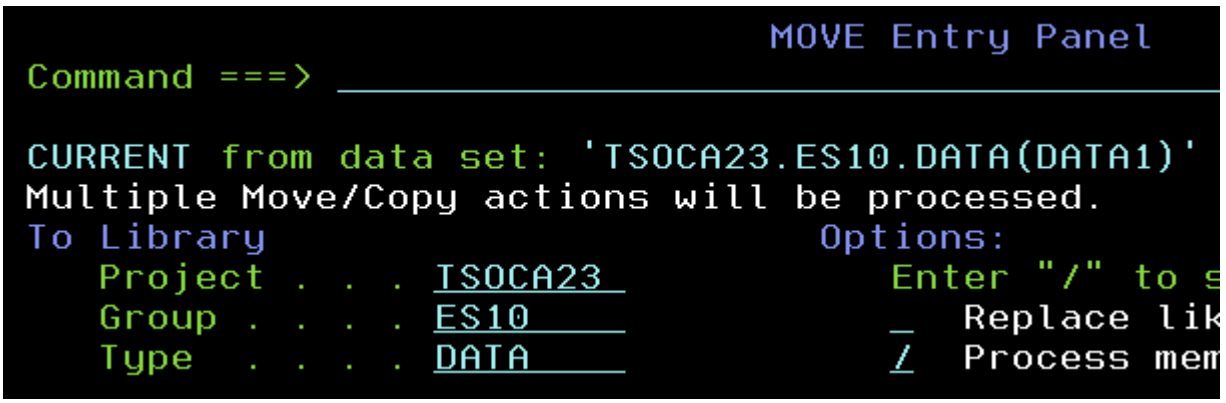


__ 41. Move members **DATA1** and **DATA3** to ***userid*.ES10.PDS**.

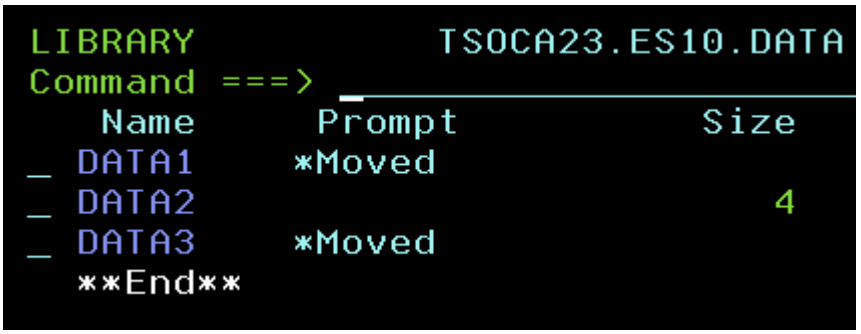
Type M (move) **next to DATA1 and DATA3**:



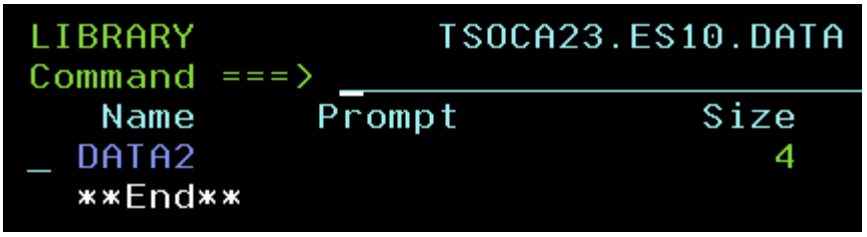
Press Enter. This opens the Move Entry panel asking for the target data set:



Enter PDS in Type, to select ***userid*.ES10.PDS** as target, and **press Enter**. The members are moved:



Enter REFRESH:



__ 42. Delete ***userid*.ES10.TEXT** and ***userid*.ES10.PDSE**.

The panel you're currently on is for managing members of PDS or PDSE data sets. To delete a data set, enter **=3.2** to go to the Data Set Utility panel.

Enter D (delete), enter ***your userid*, ES10 and TEXT** in ISPF Library, **press Enter** to delete and **Enter** again to confirm. Repeat for ***userid*.ES10.PDSE**.

This is the end of a rather long exercise. Congratulations!

End of exercise

Exercise 6. Data set lists

Estimated time

01:00

Overview

During this exercise, you will have the opportunity to become familiar with the options offered by the ISPF Data List panel. Using this menu, you will display data sets and move members.

The ISPF Data Set List panel is versatile and easy to use; most ISPF users do almost everything from this panel.

Objectives

- Utilize the ISPF Data List panel
- Display data sets
- Move members

References

SC34-4823	*Interactive System Productivity Facility (ISPF) User's Guide*
SC26-7410	*z/OS DFSMS Using Data Sets*

Exercise instructions

Preface

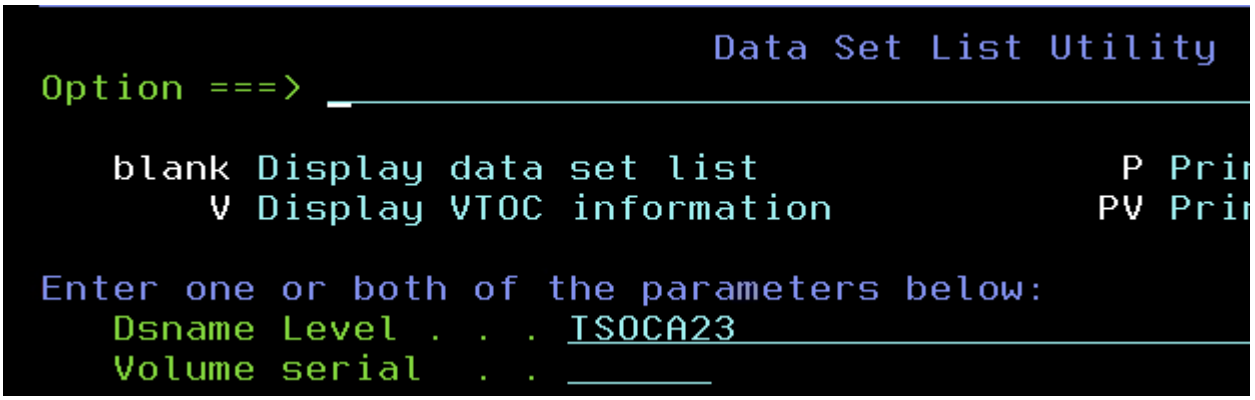
- This exercise depends on the successful completion of the previous exercises.

Section 1: Data set lists

In this exercise, you will use the Data Set List utility to perform the following tasks:

__ 1. Display a list of all data sets starting with your user ID.

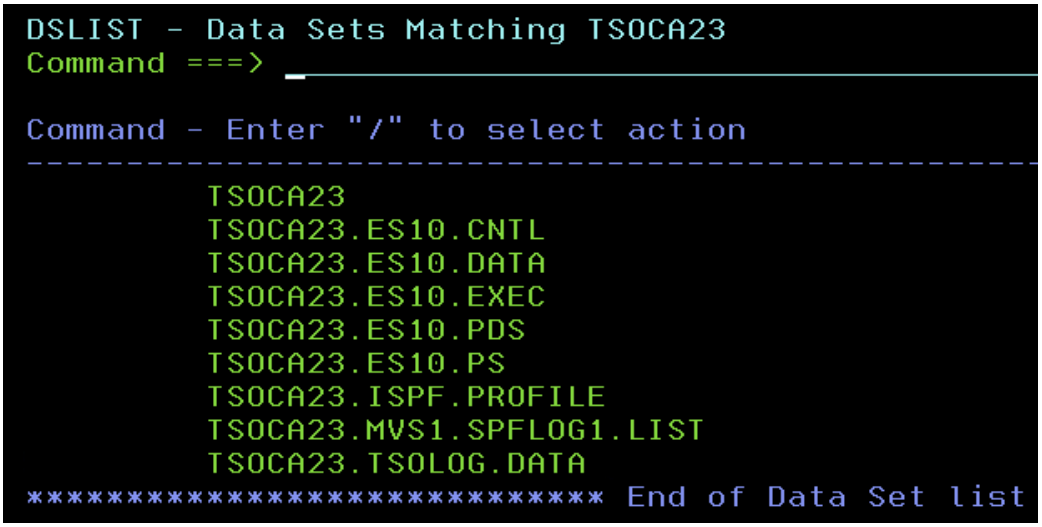
First, open the Data Set Utility panel. **Enter 3.4** on the Main Menu, or **=3.4** from any other panel. This will show:



*You will see **your userid** (not TSOCA23)* in Dsname level. This tells the utility to list all the data sets that start with your userid. In z/OS terms, the utility will list all the files that have your userid as **high-level qualifier**. As most data sets you'll work with will start with your userid (this simplifies security settings) this is the high-level qualifier you will probably use most of the time.

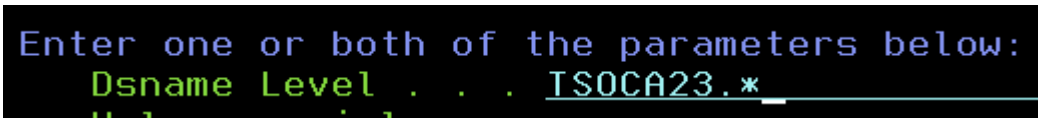
Ignore the Volume field below. It is from a time when data sets could be "not cataloged" and the system didn't know where they were, so you had to tell it.

Press Enter. The data set list appears, showing all the data sets that start with your userid. You will recognize data sets you created in previous exercises. Other data sets are created by ISPF or by the system when your userid was created:



Note

The first entry, with just your userid, is the catalog entry. This is what tells the system (among other things) where to find your data sets. It is managed by the system administrator and the system itself, and it is better not to touch it. You can exclude it from the list if you append ".*" to the Dsname level, like this:



Most users do this, and we suggest you do too.

Optional: try it now. **Press F3** to return, enter **your userid.*** in Dsname level, and **press Enter**.

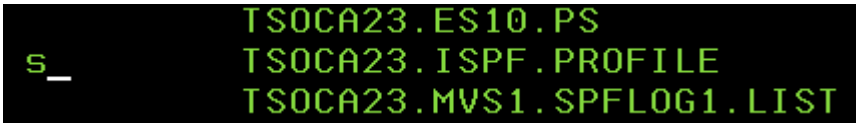
From this point on, our examples will use **userid.*** as Dsname level.

__ 2. Determine the record length and block length of ***userid*.ISPF.PROFILE:**

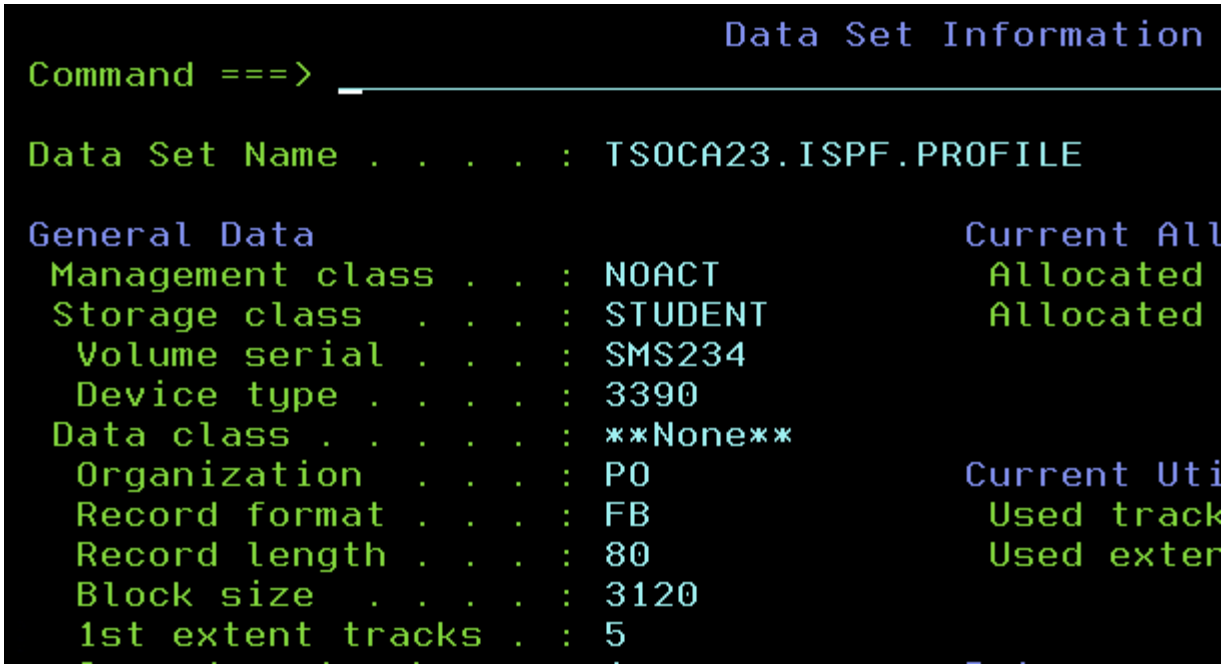
a. Record length: _____

b. Block size: _____

To do this, tab to the data set and enter **S** (Short information) or **I** (Information). Both open a panel showing the information you're after:



Press Enter. This shows the Data Set Information panel, where you can see, among other data set attributes, Record length and Block size:

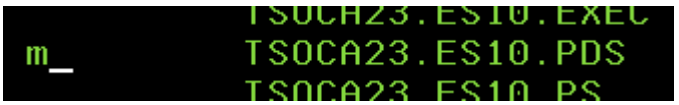


Take a minute or two to see the other attributes, such as disk space used. Don't worry about the ones you don't understand, most are managed by your system administrator.

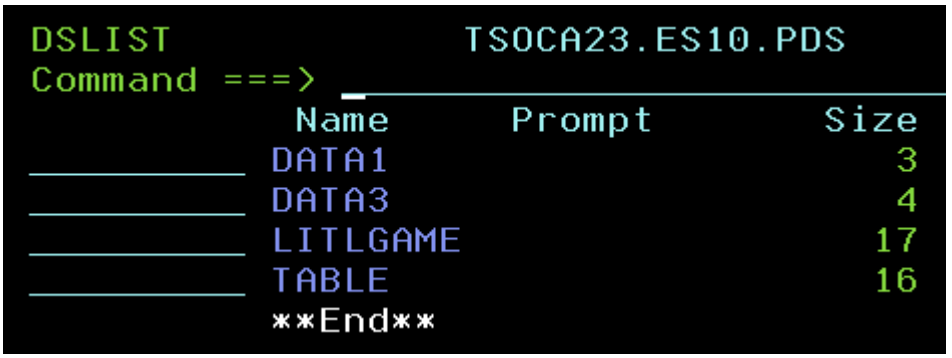
Press F3 or **Enter** to return to the data set list.

__ 3. Display a list of all members of ***userid*.ES10.PDS**.

To display a member list, **tab to the data set** and **enter M** (for, no surprises, Member list):



Press Enter to display the member list:

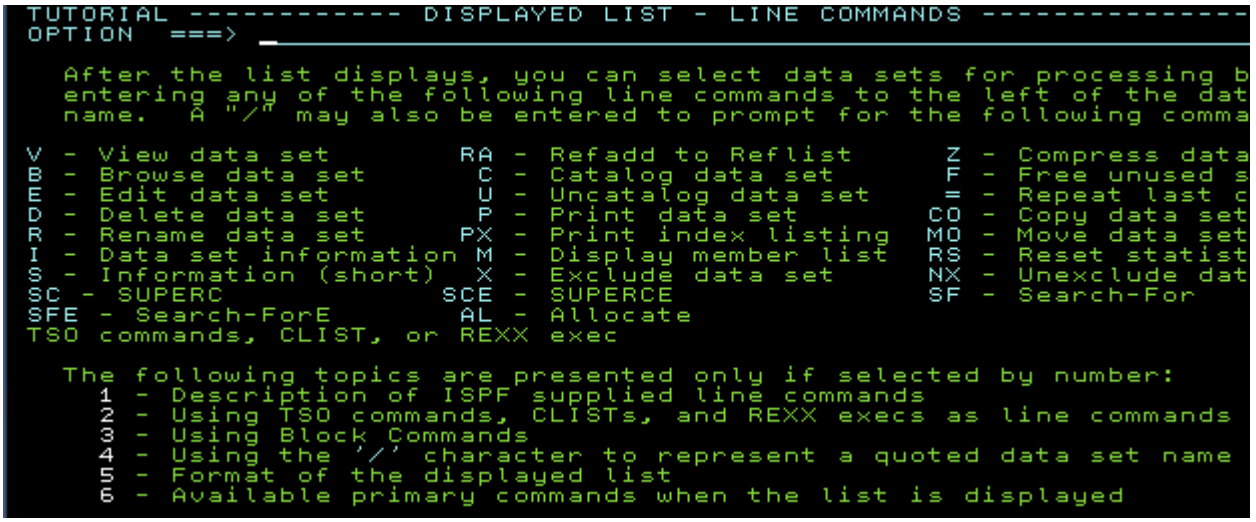


Information

A brief digression:

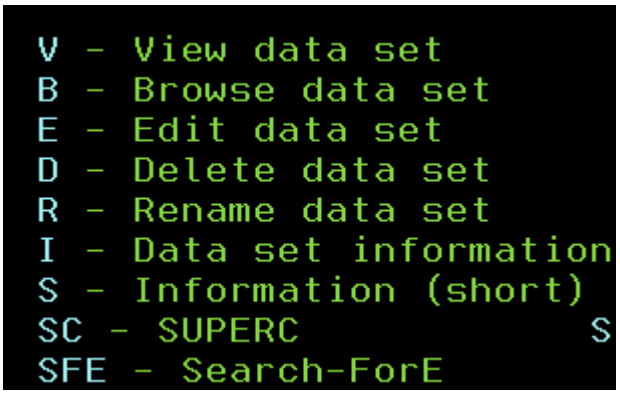
Wait a minute, I hear you say. Nice of you to tell me M is for Member list. How do I find out for myself? How do I know that here M means Member list and not Move?

ISPF comes with a very good help system, which you access by pressing **F1** (Help). If you press F1 on the Data Set List panel, you will see all the commands that you can enter next to a data set name (we will practice some of them in this lab):



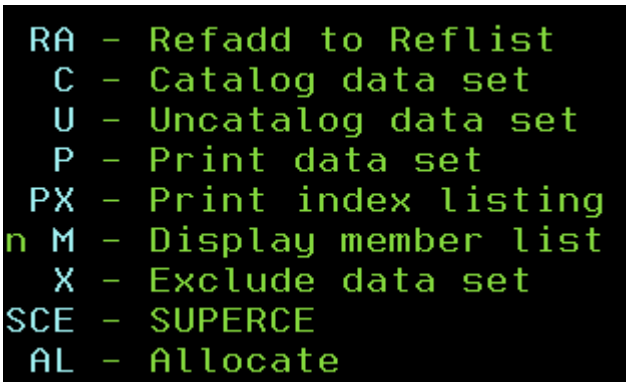
The screenshot above is very busy and barely readable (sorry), so we'll paste it below in three sections:

To the left, you have:

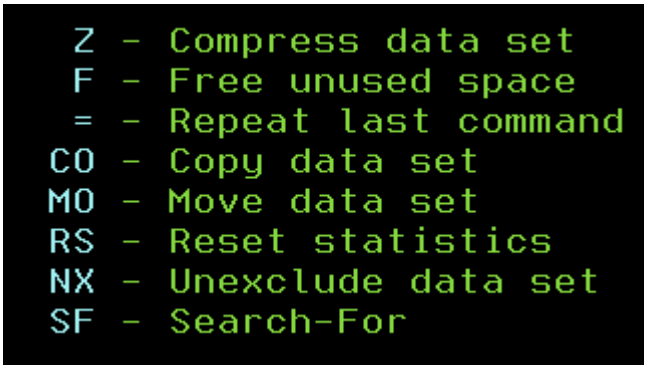


You already used a few of the functions listed above (Edit, Delete, Rename...), including S and I, from the previous step.

In the center you'll see the command we're using now, M:



From the commands shown on the right, you used Copy and Move in the last exercise:



Don’t worry about the ones you don’t understand; this course covers the ones you’ll most frequently use. You’ll learn others as you need them in your daily work (for this, F1 is your friend).

Feel free to spend time reading the help (press F1) to get to know ISPF better.

__ 4. Delete member **DATA1**.

To do this: **tab to DATA1**, **enter D** (delete), **press Enter** to delete DATA1, and **press Enter again** to confirm.

Optional: **enter REFRESH** on the command line to update the display.

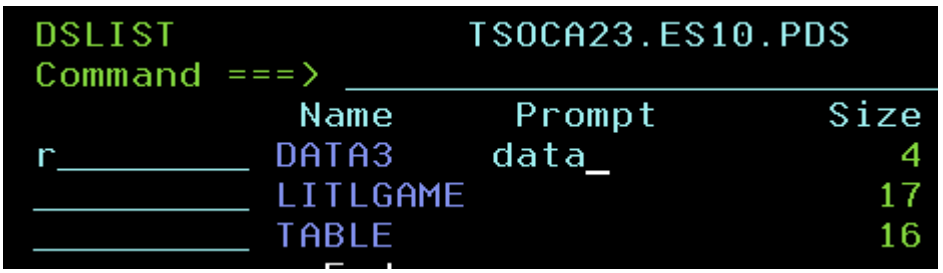
Note

This is an alternative to the way we deleted members (using option 3.1, Library Utility) in the last exercise. As you will see, in ISPF you can perform most tasks without leaving option 3.4, Data Set List.

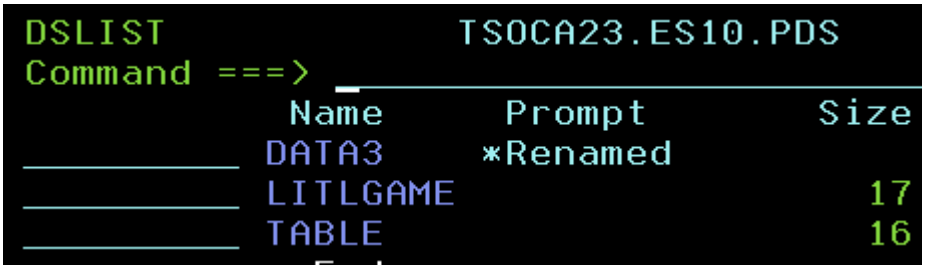
This is why we say that, when working in ISPF, you'll spend most of the time in option 3.4.

__ 5. Rename member **DATA3** to **DATA.**

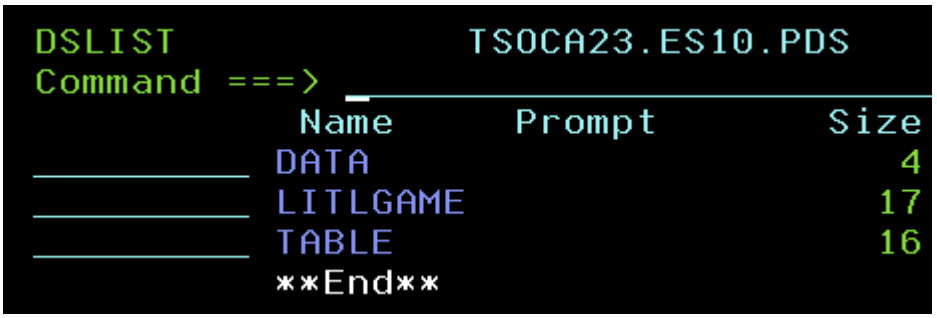
To do this: **tab to DATA3**, **enter R** (rename), **tab** to place the cursor to the right of DATA3, **type DATA**:



P**ress Enter** to rename DATA3:

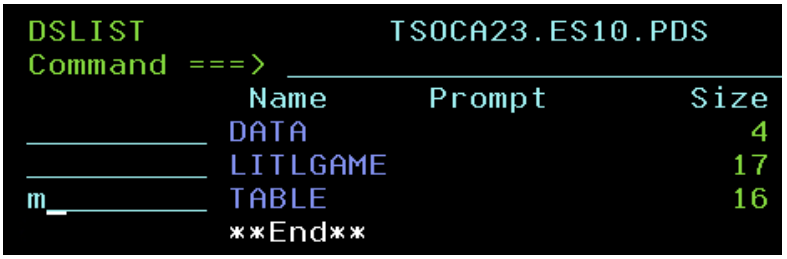


Enter REFRESH on the command line to update the display:



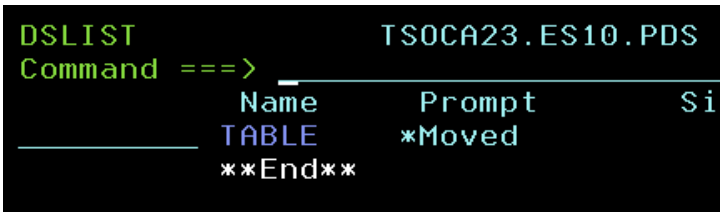
__ 6. Move member **TABLE** to data set ***userid*.ES10.DATA**. Verify the move by displaying a member list of ***userid*.ES10.DATA**.

Tab to TABLE and **enter M** (Move):

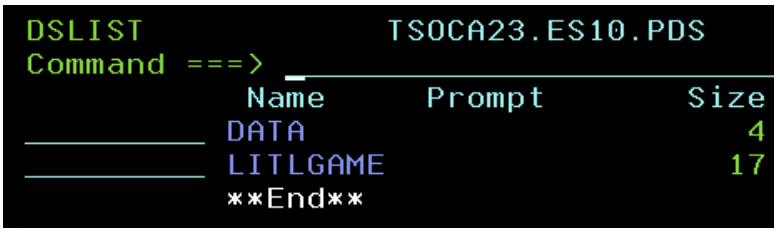


Press Enter. This opens the panel to select the move target. Select ***your userid*.ES10.DATA**:

Press Enter. You should see:

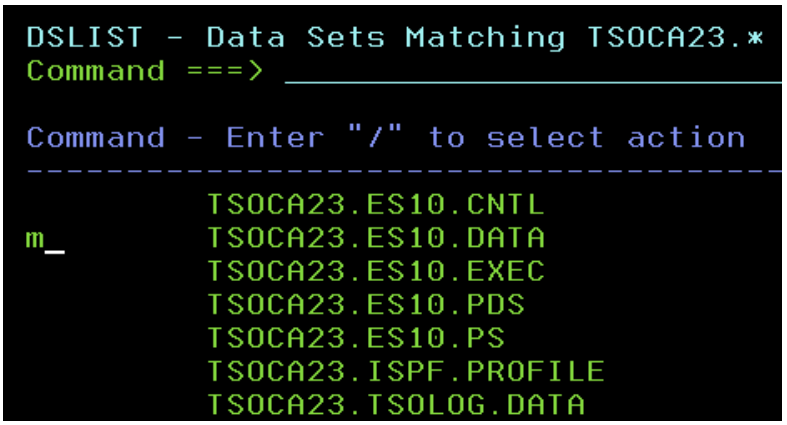


Enter REFRESH to verify that TABLE is no longer in userid.ES10.PDS:

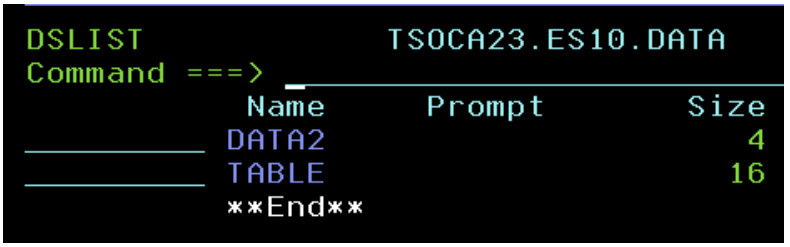


Verify the move by displaying a member list of ***userid*.ES10.DATA**. **Press F3** (End) to return to the Data Set List panel.

Tab to your userid.ES10.DATA and **enter M** (Member list):

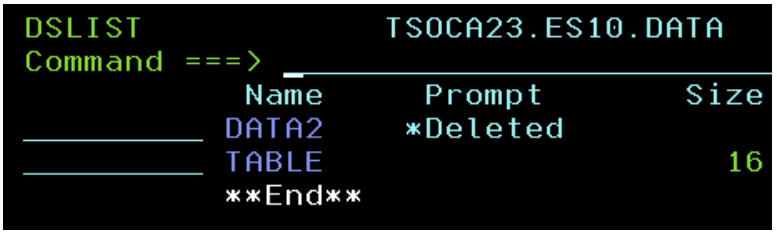


Press Enter. TABLE is now in userid.ES10.DATA:



__ 7. Delete member **DATA2** of data set ***userid*.ES10.DATA**.

You know this by now: **tab to DATA2**, **enter D** (Delete), **press Enter** to delete DATA2, and **press Enter again** to confirm:



__ 8. Delete data set ***userid*.ES10.PS**.

Press F3 (End) to go back to the Data Set List panel.

Tab to ***your userid*.ES10.PS**, **enter D** (Delete), **press Enter** to delete the data set, and **press Enter again** to confirm:

__ 9. Delete data set ***userid*.ES10.DATA**.

You know how to do this by now...

__ 10. Return to the **ISPF Primary Option** menu. (**Press F3** until you get there.)

End of exercise

Exercise 7. Using TSO/E commands

Estimated time

00:45

Overview

This exercise guides you through using TSO commands to manage data sets.

Objectives

- Utilize TSO commands
- Allocate data sets
- Verify allocation of data sets

References

SC34-4823	*Interactive System Productivity Facility (ISPF) User's Guide*
SC28-1968	*TSO/E User's Guide*

Exercise instructions

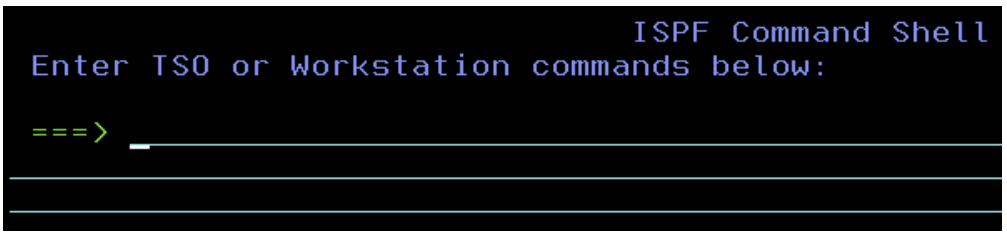
Preface

This is a short exercise that covers the very basics of TSO commands. We don't go into more details because most of the time you will be working in ISPF, which uses TSO under the covers, but presents a friendlier user interface.

Section 1: Accessing the TSO command line

__ 1. Select option **6** (Command) from the ISPF Primary Option Menu.

ISPF allows TSO commands, CLISTs, and REXX execs to be entered in the command input field of any panel. That is, you can enter commands on the command line of (say) the Editor. The Option 6 panel is very specific: it is just for entering commands.



Note

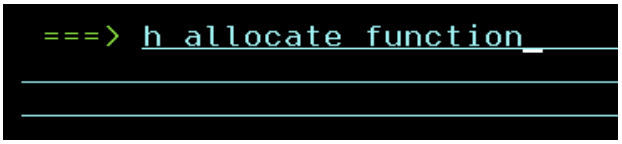
You can enter TSO commands on the command line of any ISPF panel. You just need to prefix your command with "TSO". You saw this in Exercise 3, when you executed the LITLGAME REXX EXEC: **TSO EXEC 'userid.ES10.PDS(LITLGAME)'**.

When you are in ISPF Option 6 (ISPF Command Shell), commands you enter are interpreted as TSO commands, so you won't need the "TSO" prefix.

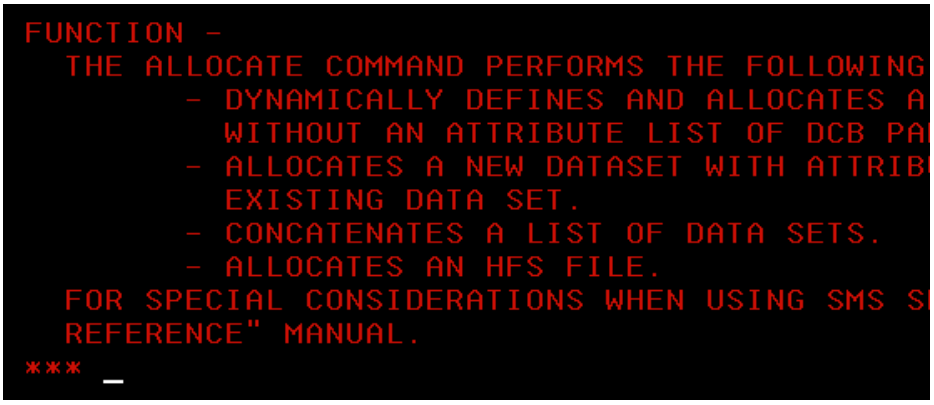
Section 2: TSO commands

__ 2. Use the proper TSO/E command to display **only the function** of the **ALLOCATE** command.

To do this, **enter H ALLOCATE FUNCTION**:



Press Enter. You will see (truncated to fit this page):



Reminder

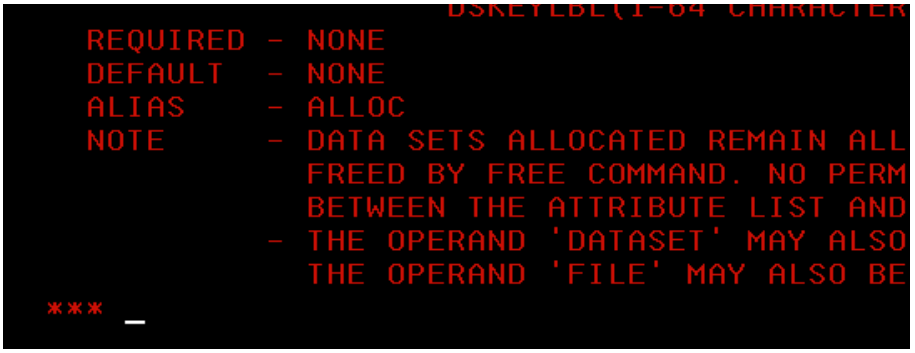
See the three asterisks (‘***’)? Remember, when you see those three asterisks, **the only thing you can do is press Enter**.

Press Enter. You will be back to the Option 6 panel.

__ 3. Use the proper TSO/E command to display only the syntax of the **ALLOCATE** command.

For this you need to enter **H ALLOCATE SYNTAX** and **press Enter**. You will see:

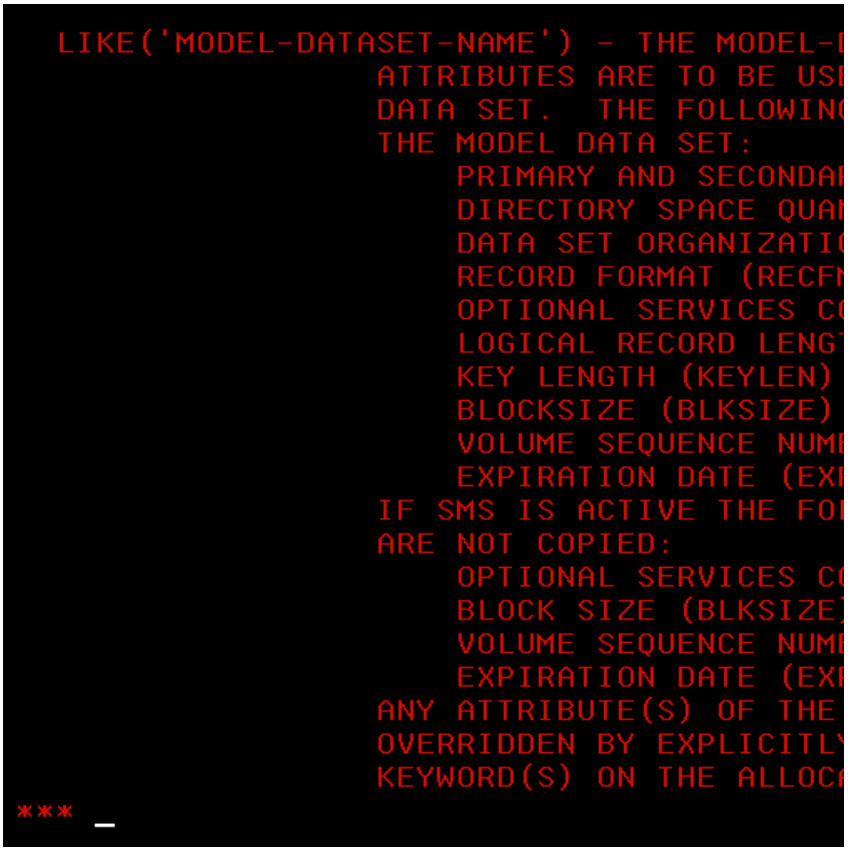
Press Enter until all the help information has been displayed (about 4 times, depending on your screen size). The last page will be:



Note the ALIAS - ALLOC. Instead of typing ALLOCATE, you can use the shorter ALLOC. We'll use ALLOC from now on.

__ 4. Find out the purpose of the **LIKE** operand of the **ALLOCATE** command.

Enter **H ALLOC OPERANDS(LIKE)** and **press Enter**:

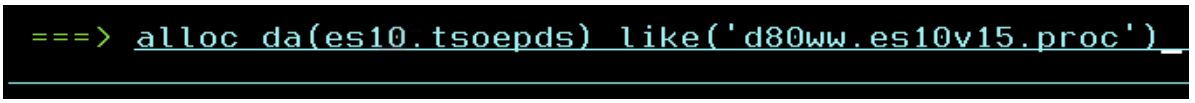


__ 5. Allocate a new data set called ***userid*.ES10.TSOEPDS**. Allocate the data set with the same characteristics as **D80WW.ES10V15.PROC**.

The command for this is **ALLOC DA(ES10.TSOEPDS) LIKE('D80WW.ES10V15.PROC')**, where:

- **ALLOC** is the ALLOCATE command alias (that is, short name). In this case, we'll create a dataset (note we can also use ALLOCATE to make existing data sets available to programs that read from or write to them).
- **DA(ES10.TSOEPDS)**: **DA** is short for DATASET. We are creating a dataset called **your userid.ES10.TSOEPDS**. As the data set name is written without quotes, TSO adds your userid prefix.
- **LIKE('D80WW.ES10V15.PROC')**: The data set we're allocating will have the same attributes as **'D80WW.ES10V15.PROC'**. That data set does not start with our userid, so we must use quotes (if we don't put quotes, TSO will think we mean **your userid.D80WW.ES10V15.PROC**).

So, enter **ALLOC DA(ES10.TSOEPDS) LIKE('D80WW.ES10V15.PROC')**:



Press Enter. You will see... nothing. If there are no errors, the command worked. Next, we'll verify this.

__ 6. Verify the proper allocation of ***userid*.ES10.TSOEPDS** by using a TSO/E command to display its characteristics as well as those of **D80WW.ES10V15.PROC**.

To display the characteristics of the data set just allocated:

Enter **LISTDS ES10.TSOEPDS**. and **press Enter**. You should see:

(Remember your data set name starts with *your* userid, not TSOCA23.)

Three asterisks. **Press Enter**.

Next, enter **LISTDS 'D80WW.ES10V15.PROC'** and **press Enter**:

Both data sets are Fixed Blocked (**FB**), Partitioned (DSORG **PO**), with 80-byte records (LRECL **80**). Note that the system ignored the inefficient block size (6160) and used the value that uses disk space most efficiently, 27920.

Note

We could have entered LISTDS for both data sets in a single command.

You can use parenthesis for the data set operand: **LISTDS (ES10.TSOEPDS)** or **LISTDS ('D80WW.ES10V15.PROC')**.

When using parenthesis, you can enter more than one data set:
LISTDS (ES10.TSOEPDS 'D80WW.ES10V15.PROC').

__ 7. Allocate a new sequential data set called ***userid*.ES10.TSOEPS** with the following characteristics:

a. Two tracks primary space, one track secondary

b. Fixed-length records of 80 bytes

c. Blocked records

The command for this is:

ALLOC DA(ES10.TSOEPS) TRACKS SPACE(2,1) LRECL(80) RECFM(F,B) DSORG(PS)

(Horrible, we know. That's why you'll almost always work with ISPF, not directly with TSO.)

Where:

DA(ES10.TSOEPS) is the data set we are creating. (No quotes, so TSO adds your userid as prefix.)

TRACKS SPACE(2,1): the new data set will have initially 2 disk tracks (each track is about 50K bytes). If it needs more than 2 tracks, it will grow 1 track at a time, up to 15 times.

LRECL(80): records in this data set have a maximum of 80 bytes.

RECFM(F,B): the record format is fixed (F), so all records have exactly 80 bytes. It is also blocked (B), so records are grouped in blocks before being written out to disk.

DSORG(PS): this is a sequential data set (PS = Physical Sequential).

OK let's do it.
Enter
ALLOC DA(ES10.TSOEPS) TRACKS SPACE(2,1) LRECL(80) RECFM(F,B) DSORG(PS):

Press Enter. If the command worked, you will see nothing.

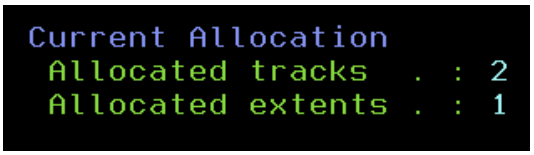
__ 8. Verify whether the data set has been allocated with the right attributes.

Enter LISTDS ES10.TSOEPS and **press Enter**. You should see:

Record format (**FB**), record length (**80**), and organization (**PS**) are what we wanted. So far so good.

Optional

What about disk space? To check that, you'll need to go to option 3.4 and enter I (Information) next to the data set name. You should see:



We won't do it now, but feel free to do it yourself if you want to.

Note

Although we used ALLOCATE to create data sets, the command is also used to establish a link to existing data sets, so that application programs can access them. It is similar to a DD in JCL.

For example, if you want to run a program that reads from **userid.ES10.TSOEPS** using the DD name **ALLOCPS**, you will enter this:

ALLOC F(ALLOCPS) DA(ES10.TSOEPS) SHR

Where:

F(ALLOCPS): File name (DD name) is ALLOCPS. The program reading the data set uses this to refer to the data set.
DA(ES10.TSOEPS): We're allocating (accessing) the data set **userid.ES10.TSOEPS**.

SHR: we are accessing the data set as SHARED. Other programs can read from it concurrently. To access the data set exclusively (typically, when you're writing to it, or when you don't want others updating it while you read it), use **OLD**. When you enter neither SHR nor OLD, the default is NEW, which means "create the data set" (which explains why the ALLOCATE commands we used earlier created new data sets).

To check which data sets are allocated, you can use LISTALC (alias LISTA). To list allocated data sets and their file (DD) names:

LISTA ST

When the program no longer needs the data set, you usually enter the opposite of ALLOCATE: **FREE**. FREE deallocates the data set (makes it available to other programs). To deallocate the data set we allocated above:

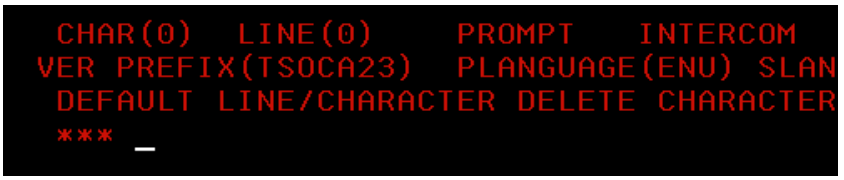
FREE F(ALLOCPS)

__ 9. Display your TSO/E profile and change the prefix setting to **HUGO**.

Note

It is unlikely that you will ever need to use the PROFILE command. We use it here to practice TSO and show how the data set prefix works.

To display your profile, **enter PROFILE**:

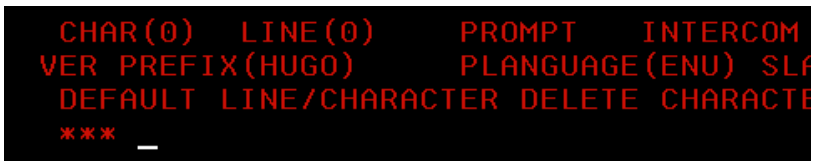


Note **PREFIX(your userid)**. This is why TSO prefixes your userid to data set names entered without quotes.

Three asterisks, so **press Enter**.

To change your data set name prefix to HUGO:

Enter PROFILE PREFIX(HUGO), then **enter PROFILE** to display and verify:



Three asterisks, so **press Enter**.

__ 10. **Enter LISTDS ES10.TSOEPS**. Last time this command worked. Now, you will see this error:

TSO added HUGO as prefix, and we know that HUGO.ES10.TSOEPS doesn't exist.

__ 11. Reset the prefix to its previous value (your userid).

Enter PROFILE PREFIX(your userid)

Enter LISTDS ES10.TSOEPS. This time it should work. If it didn't, make sure you entered your userid correctly in PREFIX(your userid).

__ 12. **Enter LISTDS**

We forgot to enter the expected data set name. TSO ***prompts*** us to enter it:

__ 13. **Press the ESC Key** to terminate the command. If you are in full screen mode, you have to **press ESC twice**. The first time takes you out of full screen more. The second time terminates the command. You should see:

Note

Remember that you can also interrupt any command by entering **PA1**: **right-click** on the screen to bring up the **pop-up keypad** then press on **PA1**.

__ 14. Change the profile setting to **NOPROMPT**.

Enter PROFILE NOPROMPT and **press Enter**.

__ **15.** **Enter LISTDS** again. This time TSO, instead of asking (prompting) for the missing operand, issues an error message:

__ 16. Reset the profile to **PROMPT**. **Enter PROFILE PROMPT** and **press Enter**.

Note

When you enter incorrect information with a command or when the system requires further information from you, the system issues a message to prompt you for the information. To control whether you receive these system messages, use PROFILE PROMPT/NOPROMPT.

If you do not want to receive the system messages, use PROFILE NOPROMPT.

The PROMPT operand allows you to receive these messages at the terminal and is the default with the PROFILE command.

End of exercise

Glossary

This glossary includes terms and definitions from:

- The *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 11 West 42nd Street, New York, New York 10036. Definitions are identified by the symbol (A) after the definition.
- The ANSI/EIA Standard- 440-A, *Fiber Optic Terminology*. Copies can be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue, N.W., Washington, DC 20006. Definitions are identified by the symbol (E) after the definition.
- The *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.
- The Network Working Group Request for Comments: 1208.

The following cross-references are used in this glossary:

Contrast with: This refers to a term that has an opposed or substantively different meaning.

Synonym for: This indicates that the term has the same meaning as a preferred term, which is defined in its proper place in the glossary.

Synonymous with: This is a backward reference from a defined term to all other terms that have the same meaning.

See: This refers the reader to multiple-word terms that have the same last word.

See also: This refers the reader to terms that have a related, but not synonymous, meaning.

Deprecated term for: This indicates that the term should not be used. It refers to a preferred term, which is defined in its proper place in the glossary.

A

AC:

See *Alternating Current.*

Access:

1)To obtain computing services or data.
2)In computer security, a specific type of interaction between a subject and an object that results in flow of information from one to the other.

Access-any mode:

One of the two access modes that can be set for the storage system during initial configuration. It enables all Fibre Channel-attached host systems with no defined access profile to access all logical volumes on the storage system. With a profile defined in DS8000 Storage Management GUI for a particular host, that

host has access only to volumes that are assigned to the WWPN for that host. See also *pseudo host* and *worldwide port name*.

Access Control Lists (ACLs):

Are used to control access to files and directories by individual user (UID) and group (GID). ACLs are used in conjunction with permission bits.

ACK:

See *request for acknowledgment and acknowledgment*.

Adaptive Multi-stream Prefetching (AMP):

An autonomic, workload-responsive, self-optimizing prefetching technology that adapts the amount of prefetch and the timing of prefetch on a per-application basis to maximize the performance of the system.

Adaptive Replacement Cache (ARC):

A page replacement algorithm with better performance than LRU (Least Recently Used). This is accomplished by keeping track of both frequently used and recently used pages plus a recent eviction history for both.

Address space:

Is the amount of memory allocated for all possible addresses for a computational entity, such as a device, a file, a server, or a networked computer.

Advanced Encryption Standard (AES):

Is a symmetric block cipher used by the US government to protect classified information and is implemented in software and hardware throughout the world to encrypt sensitive data. A block cipher is a method of encrypting text (to produce ciphertext) in which a cryptographic key and algorithm are applied to a block of data (for example, 63 contiguous bits) at once as a group rather than to 1 bit at a time.

Agent:

A program that automatically initiates some service without user intervention or on a regular schedule. See also *subagent*.

Alert:

A message or log that a storage system generates as the result of error event collection and analysis. An alert indicates that a service action is required.

Aliases:

The number of parallel access volumes (PAVs) defined to be used by a particular volume, or, when HyperPAV is enabled, any volume within the LSS.

All-Flash configuration:

A high-performance storage configuration that supports only high-performance flash enclosures.

Allegiance:

For IBM Z products, a relationship that is created between a device and one or more channel paths during the processing of certain conditions. See also *implicit allegiance*, and *reserved allegiance*.

`ALLOCATE` command (In UNIX):

Use the `ALLOCATE` command to dynamically allocate VSAM, non-VSAM, and Hierarchical File System (HFS) data sets.

Allocated storage:

The space that is allocated to volumes but not yet assigned. Contrast with *assigned storage*.

Allocation method:

The means by which capacity is allocated for volumes from within a pool. Possible values include rotate capacity, rotate volumes, and managed.

Alternating Current (AC):

A type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. Current flowing in power lines and normal household electricity that comes from a wall

outlet is alternating current. The standard current used in the US is 60 cycles per second (that is, a frequency of 60 Hz); in Europe and most other parts of the world it is 50 cycles per second (that is, a frequency of 50 Hz.).

American National Standards Institute (ANSI):

A private, nonprofit organization whose membership includes private companies, US government agencies, and professional, technical, trade, labor, and consumer

organizations. ANSI coordinates the development of voluntary consensus standards in the US

American Standard Code for Information Interchange (ASCII):

Is the most common format for text files in computers and on the Internet. In an ASCII file, each alphabetic, numeric, or special character is represented with a 7-bit binary number (a string of seven 0s or 1s). 128 possible characters are defined.

AMP:

See *Adaptive Multi-stream Prefetching.*

Another Network Block Device (ANBD):

Is a compatible NBD (Network Block Device) extension from 2003. It supports multithreading and promises better error messages than its predecessor.

Anonymous:

In the DS8000 Storage Management GUI, the label on an icon that represents all connections that are using Fibre Channel adapters between the storage system and hosts but are not completely defined to the storage system. See also *anonymous host*, *pseudo host*, and *access-any mode*.

Anonymous host:

Synonym for *pseudo host*. Contrast with *anonymous* and *pseudo host*.

ANSI:

See *American National Standards Institute*.

AOS:

See *Assist On Site.*

APAR (Authorized Program Analysis Report):

A request for correction of a problem caused by a defect in a current release of a program unaltered by the user.

Application programming interface (API):

Is a set of routines, protocols, and tools for building software applications. An API specifies how software components should interact and APIs are used when programming graphical user interface (GUI) components.

Application Specific Integrated Circuit (ASIC):

Is a microchip designed for a special application, such as a particular kind of transmission protocol or a hand-held computer.

Arbitrated loop:

For Fibre Channel connections, a topology that enables the interconnection of a set of nodes. See also *point-to-point connection* and *switched fabric*.

ARC:

See *Adaptive Replacement Cache.*

Array:

A structure that contains an ordered collection of elements of the same data type in which each element can be referenced by its index value or ordinal position in the collection. In the storage system, an array is a group of disks that the user designates to be managed by the RAID technique. See also *Redundant Array of Independent Disk* (RAID).

Array site:

A group of identical drives (same capacity,

speed, and drive class). Which drives from an array site is predetermined automatically by the DS8000. There is no predetermined processor node affinity for array sites. Array sites are the building blocks that are used to define arrays.

ASCII:

See *American Standard Code for Information Interchange.*

ASIC:

See *Application Specific Integrated Circuit.*

Assigned storage:

The space that is allocated to a volume and that is assigned to a port.

Assist On Site (AOS):

The components of Assist On-site (AOS) interact together to start and maintain a support session between the support engineer and the customer.

Asymmetric encryption:

Also known as public-key encryption, symmetric versus asymmetric encryption utilizes a pair of keys; a public key and a private key. If you encrypt data with the public key, only the holder of the corresponding private key can decrypt the data, hence ensuring confidentiality. Many 'secure' online transaction systems rely on asymmetric encryption to establish a secure channel. SSL, for example, is a protocol that utilizes asymmetric encryption to provide communication security on the Internet. An asymmetric encryption algorithm typically involve exponential operations. They are not lightweight in terms of performance. For that reason, asymmetric algorithms are often used to secure key exchanges rather than used for bulk data encryption.

Availability:

The degree to which a system or resource is capable of performing its normal function. See *data availability*.

B

Bandwidth:

Defined as the amount of data that can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second.

Bare-metal hypervisor:

Type-1, native or bare-metal hypervisors: These hypervisors run directly on the host's hardware to control the hardware and to manage guest operating systems. For this reason, they are sometimes called bare metal hypervisors.

Type-2 or hosted hypervisors:

These hypervisors run on a conventional operating system just as other computer programs do. A guest operating system runs as a process on the host. Type-2 hypervisors abstract guest operating systems from the host operating system.

Base addressing space:

On an extended address volume, this term refers to cylinders with addresses below 65,536. These cylinder addresses are represented by 16-bit cylinder numbers or by 28-bit cylinder numbers with high order 12 bits of zero (0).

Batch processing:

Batch Processing is used for programs that can be executed with minimal human interaction and at a scheduled time or on an as-needed basis.

Battery Service Module (BSM) set:

The DC-UPS contains integrated battery sets known as Battery Service Modules (BSM) sets. The BSM set is composed of four BSM modules. The BSM sets help protect data if there is a loss of external power to the frame. If there is a complete loss of AC input power to the frame, the

batteries are used to maintain power to the processor complexes and I/O enclosures for sufficient time to allow the contents of NVS memory (modified data that is not yet destaged from cache) to be written to the hard disk drives internal to the processor complexes (not the storage enclosure drives).

Bay:

A physical space into which a device can be physically mounted and connected to power and data. For example, a power supply or a disk drive might be inserted into a bay. See also *service boundary*.

Block:

A string of data elements recorded, processed, or transmitted as a unit. The elements can be characters, words, or physical records. A group of contiguous sectors on a disk that contains a block header and some integral number of records. All blocks on the storage device are the same size (fixed size). See also *fixed-block architecture* and *data record*.

Break Point Value (BPV):

When a disk space request is this size or more, the system prefers to use the cylinder-managed space for that extent. This applies to each

request for primary or secondary space for data sets that are eligible for the cylinder-managed space. If not enough cylinder-managed space is available, then the system uses the
track-managed space or will use both areas. The breakpoint value is expressed in cylinders. When the size of a disk space request is less than the breakpoint value, the system prefers to use the track-managed area. If not enough space is available there, then the system will use the cylinder-managed space, or will use both areas.

BSM:

See *Battery Service Module (BSM) set*.

Business Class configuration:

A high-density, high-performance storage configuration that includes standard disk enclosures and high-performance flash enclosures and is optimized and configured for cost, by minimizing the number of device adapters and maximizing the number of storage enclosures that are attached to each storage system.

C

Cache:

Memory used to improve access times to instructions, data, or both. Data that resides in cache memory is normally a copy of data that resides elsewhere in slower, less expensive storage, such as on a disk or on another network node.

Cache fast write:

A form of the fast-write operation in which the storage server writes the data directly to cache, where it is available for later destaging.

Cache hit:

An event that occurs when a read operation is sent to the cluster, and the requested data is found in cache. Contrast with cache miss.

Cache memory:

Memory, typically volatile memory, that a storage server uses to improve access times to instructions or data. The cache memory is

typically smaller and faster than the primary memory or storage medium. In addition to residing in cache memory, the same data also resides on the storage devices in the storage system.

Cache miss:

An event that occurs when a read operation is sent to the cluster, but the data is not

found in cache. Contrast with cache hit.

Call home:

A communication link established between the storage product and a service provider. The storage product can use this link to place a call to IBM or to another service provider when it requires service. With access to the machine, service personnel can process service tasks, such as viewing error logs and problem logs or initiating trace and dump retrievals. See also heartbeat and *Remote Technical Assistance Information Network* (RETAIN).

Capacity Backup (CBU):

Provides the ability to replace model capacity or specialty engines to a backup server in the event of an unforeseen loss of server capacity because of an emergency.

Capacity Upgrade on Demand (CUoD):

Activates additional processors and memory units on selected servers by purchasing a permanent processor or memory unit activation feature. CUoD adds capacity for new workloads, which enables the server to adapt to unexpected performance demands.

Cascading:

1)Connecting network controllers to each other in a succession of levels to concentrate many more lines than a single level permits.
2)In high-availability cluster system MultiProcessing (HACMP), pertaining to a system configuration in which the system node with the highest priority for a particular resource acquires the resource if the primary node fails. The cluster system node relinquishes the resource to the primary node upon reintegration of the primary node into the system.

Cataloged procedure:

A procedure that is stored as a member of a PDS or PDSE is a cataloged procedure. The data set containing the procedure can either be a private or system data set.

CBU:

See *Capacity Backup.*

CDS:

See *Couple Data Set.*

Central Electronic Complex (CEC):

The set of hardware that defines a mainframe, which includes the CPU(s), memory, channels, controllers, and power supplies included in the system. A physical collection of hardware that consists of main storage, one or more Central Processors (CPs), timers, and channels.

CF:

See *Coupling facility.*

CFCC:

See *Coupling Facility Control Code.*

Central Processing Unit (CPU):

Is the primary component of a computer that processes instructions. It runs the operating system and applications, constantly receiving input from the user or active software programs. It processes the data and produces output, which may stored by an application or displayed on the screen.

Central Processor (CP):

The part of the computer that contains the sequencing and processing facilities for instruction execution, initial program load, and other machine operations. CPs execute instructions.

Central Processor Complex (CPC):

Refers to the physical collection of hardware that includes main storage, one or more central processors, timers, and channels.

CGI:

See *Common Interface Gateway.*

Change Mode (CMOD):

In UNIX-like operating systems, chmod is the

system and system call, which may change the access permissions to file system objects (files and directories).

Channel:

The part of a channel subsystem that manages a single I/O interface between a channel subsystem and a set of control units.

Channel Path Identifier (CHPID):

The channel, represented by a channel path ID or CHPID, represents the actual communication path. A CHPID is the handle by which communication between the CPC and an external device is facilitated. A CHPID must be unique, since it denotes a unique path of communication for the CPC. The maximum number of allowable CHPIDs within a channel subsystem is 256. Channels can be shared between LPARs. A CHPID is associated with either a physical port or with an internal connection defined inside the mainframe. Valid CHPIDs are in the hexadecimal range from X'00' through X'FF'.

Channel Command Word (CCW):

An instruction to a specialized I/O channel processor, which is, in fact, a finite state machine. It is used to initiate an I/O operation, such as 'read', 'write' or 'sense', on a channel-attached device. On system architectures, which implement channel I/O, typically all devices are connected by channels, and so all I/O requires the use of CCWs.

CICS:

See *Customer Information Control System.*

CIM:

See *Common Information Model.*

Ciphertext:

Data that has been encrypted. Ciphertext is unreadable until it has been converted into plaintext (decrypted) with a key.

Citrix XenServer:

Is a server virtualization platform based on the Xen hypervisor that allows IT administrators to host, deploy, and manage virtual machines.

CIU:

See *Customer Initiated Upgrade.*

CKD:

See *Count Key Data*.

Cloud:

A cloud is a vast array of computers that are hooked together and meant to operate as a single ecosystem. Clouds are configured to offer one or more services (for example, data storage, content delivery, or applications) and users can access these services remotely.

Cloud Management Platform (CMP):

A Cloud Management Platform is software, which combines a set of features or modules, which enable the management of different cloud environments. Public, private, and hybrid cloud cannot be all handled with a simple virtualization management console.

Cluster:

A partition capable of processing all DS8000 series functions. With two clusters in the storage system, any operational cluster can take over the processing of a failing cluster.

Cluster Structure Storage System (CSS):

CSS is a novel, high-performance disk storage system. CSS divides its disk space into large, fix-sized clusters, which are the basic units for disk reads and writes.

CMOS: See *Complementary Metal–Oxide–Semiconductor.*

CMPSC: See *Compression Coprocessor.*

Cold demotion:

An operation of IBM Easy Tier automatic mode. The movement of an extent of inactive data to a lower tier to make its tier available for new data.

Common Information Model (CIM):

Is an open standard that defines how managed elements in an IT environment are represented as a common set of objects and relationships between them.

Command List (CLIST):

CLIST is a procedural programming language for TSO in z/OS systems.

Command Line Interface (CLI):

An interface that defines a set of commands and enables a user to issue these commands by entering text in response to the command prompt (for example, DOS commands or UNIX shell commands). See also *IBM DS CLI.*

Command parameter:

Defines a parameter of a command being created.

Common Gateway Interface (CGI):

Was introduced to enable and standardize the interface between Web servers and external programs. The CGI is a relatively simple, platform and language independent, industry-standard interface for Web application development. Programs that implement the CGI standard are commonly called CGI programs.

Complementary Metal-Oxide-Semiconductor (CMOS):

CMOS is a technology for constructing integrated circuits. CMOS technology is used in microprocessors, micro controllers, static RAM, and other digital logic circuits.

Compression Coprocessor (CMPSC):

Is a high-performance coprocessor that uses compression algorithms to help reduce disk space and memory usage. Each processor unit has a dedicated CMPSC that connects to the main cache-structure for better throughput of the compression dictionaries.

Computer program:

A computer program is a list of instructions that tell a computer what to do.

Concurrent copy:

A facility on a storage server that enables a program to make a backup of a data set while the logical volume remains available for subsequent processing. The data in the backup copy is frozen at the point in time that the server responds to the request.

Concurrent installation of licensed machine code:

Process of installing Licensed Internal Code on a DS8000 series while applications continue to run.

Configure:

In storage, to define the logical and physical devices, optional features, and program products of the input/output subsystem through the user interface that the storage system provides for this function.

Configuration task commands:

Used for creating, modifying, and deleting resources.

Consistency group:

A group of volumes participating in FlashCopy relationships in a logical subsystem, across logical subsystems, or across multiple storage systems that must be kept in a consistent state to ensure data integrity.

Consistency group interval time:

The value in seconds that indicates the length of time between the formation of consistency groups.

Consistent copy:

A copy of a data entity (a logical volume, for example) that contains the contents of the entire data entity at a single instant in time.

Console:

A user interface to a server, for example, the interface provided on a personal computer.

See also *Hardware Management Console*.

Control path:

The route that is established from the master storage system to the subordinate storage system when more than one storage system participates in a Global Mirror session. If there is only one storage system (the master) in the Global Mirror session, no control path is required.

Control unit:

1)A device that coordinates and controls the operation of one or more input/output devices, and synchronizes the operation of such devices with the operation of the system as a whole.
2)For IBM Z, a storage server with FICON or OEMI interfaces. The control unit adapts a native device interface to an I/O interface that an IBM Z Systems host system supports.
3)The portion of the storage system that supports the attachment of emulated count key data devices over ESCON, FICON, or OEMI interfaces. See also *cluster*.

Control-unit image:

In mainframe computing, a logical subsystem that is accessed through an ESCON I/O interface. One or more control-unit images exist in each control unit. Each image appears as an independent control unit, but all control-unit images share a common set of hardware facilities. The DS8000 series can emulate 3990-3, TPF, 3990-6, or 2105 control units.

Control-Unit-Initiated Reconfiguration (CUIR):

A software mechanism that the DS8000 series uses to request that an operating system of IBM Z host verify that one or more subsystem resources can be taken offline for service. The DS8000 series can use this process to automatically vary channel paths offline and online to facilitate bay service or concurrent code installation. Depending on the operating system, support for this process might be model-dependent, might depend on the IBM Enterprise Storage Server Subsystem Device Driver, or might not exist.

Copy Services:

A collection of optional software features, with a web-browser interface, that is used for configuring, managing, and monitoring data-copy functions.

Core:

See *processor.*

Count field:

The first field of a Count Key Data (CKD) record. This 8-byte field contains a 4-byte track address (CCHH). It defines the cylinder and head that are associated with the track, and a 1-byte record number (R) that identifies the record on the track. It defines a 1-byte key length that specifies the length of the record's key field (0 means no key field). It defines a 2-byte data length that specifies the length of the record's data field (0 means no data field). Only the end-of-file record has a data length of zero.

Count Key Data (CKD):

In mainframe computing, a data-record format employing self-defining record formats in which each record is represented by up to three fields: a *count* field that identifies the record and specifies its format, an optional *key* field that identifies the data area contents, and an optional *data* field that typically contains the user data. For CKD records on the storage system, the logical volume size is defined in terms of the device emulation mode (3390 or 3380 track format). The count field is always 8 bytes long and contains the lengths of the key and data fields, the key field has a length of 0 to 255 bytes, and the data field has a length of 0

to 65 535 or the maximum that will fit on the track. See also *data record*.

Couple Data Set (CDS):

Couple data sets provides a central shared repository of data that needs to be visible to every system in the sysplex. The CDS and all accesses to the data therein are managed by XCF.

Coupling Facility (CF):

Is a piece of computer hardware which allows multiple processors to access the same data. A Parallel Sysplex relies on one or more Coupling Facilities (CFs).

Coupling Facility Control Code (CFCC):

Is an IBM licensed Internal Code that always runs under an LPAR, regardless of whether the CF is in a standalone CPC or in a general purpose CPC.

Coupling Facility Resource Management (CFRM):

Allows you to define how z/OS is to manage coupling facility resources.

CP:

See *Central Processor.*

CP Assist for Cryptographic Function (CPACF):

Is a set of cryptographic instructions providing improved performance.

CPC:

See *Central Processing Complex.*

CPU:

See *Central Processing Unit.*

CRC:

See C*yclic Redundancy Check*.

Cross-cluster communication:

DS8880 uses PCIe paths between the I/O enclosures to provide the cross-cluster (XC) communication between CPCs. This configuration means that no separate path is between the XC communications and I/O traffic, which simplifies the topology. During normal operations, the XC communication traffic uses a small portion of the overall available PCIe bandwidth (less than 1.7%) so that the XC communication traffic has a negligible effect on I/O performance.

Cross-System Coupling Facility (XCF): Is a component of z/OS that manages communications between applications in a sysplex. Applications may be on the same system or different systems.
Systems communicate using messages transported by one of two mechanisms: Dedicated channel-to-channel links (CTC links) and Structures in a Coupling Facility, only available in Parallel Sysplex, not in standard sysplex.

Cross-System Extended Services (XES):

A component of z/OS, enables applications and subsystems to take advantage of the coupling facility.

Cryptography:

(1)The transformation of data to conceal its information content and to prevent its unauthorized use or undetected modification.
(2)Protecting information by transforming it (encrypting it) into an unreadable format, called ciphertext. Only those who possess a secret key can decipher (or decrypt) the message into plaintext.

CRUD:

Create, Read, Update, and Delete as an acronym CRUD, are the four basic functions of persistent storage.[

CU:

See *Control Unit.*

CUoD:

See *Capacity Upgrade on Demand.*

CUIR:

See *Control-Unit Initiated Reconfiguration*.

Customer Information Control System (CICS):

Is an online transaction processing monitor from IBM that acts as an interface between the operating system and application programs to provide rapid high-volume online transaction processing.

Customer Initiated Upgrade (CIU):

Is an IBM on-line system through which you can order, download, and install temporary and permanent upgrades for IBM Z servers.

Cylinder-managed space:

This term refers to the space on the volume that is managed only in multicylinder units. Cylinder-managed space begins at cylinder address 65520. Each data set occupies an integral multiple of multicylinder units. Space requests targeted for the cylinder-managed space will be rounded up to the next multicylinder unit. The cylinder-managed space exists only on EAVs.

Cylinder:

A unit of storage on a CKD device with a fixed number of tracks.

Coarse Wavelength Division Multiplexing (CWDM):

Is a method of combining multiple signals on laser beams at various wavelengths for transmission along fiber optic cables, such that the number of channels is fewer than in Dense Wavelength Division Multiplexing (DWDM) but more than in standard Wavelength Division Multiplexing (WDM).

D

DA:

See *Device Adapter*.

Daisy chain:

See *serial connection*.

DASD:

See *Direct Access Storage Device*.

DASD fast write (DFW):

A function in which data is written concurrently to cache and nonvolatile storage, and automatically scheduled for destaging to DASD. Both copies are retained in the storage control until the data is completely written to the DASD, providing data integrity equivalent to writing directly to the DASD. Use of DASD fast write for system-managed data sets is controlled by storage class attributes to improve performance.

DAT:

See *Dynamic Address Translation.*

Data availability:

The degree to which data is available when needed, typically measured as a percentage of time that the system would be capable of responding to any data request (for example, 99.999% available).

Data Base 2 (DB2):

DB2 provides an open database environment that runs on a wide variety of computing platforms.

Data compression:

The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

Data Facility Storage Management Subsystem data set services (DFSMSdss) utilities:

DFSMSdss is a component of DFSMS (Data Facility Storage Management Subsystem). It is used to move and replicate data, manage storage space efficiently, backup and recover data, and convert data sets and volumes.

Data field:

The optional third field of a Count Key Data (CKD) record. The count field specifies the

length of the data field. The data field contains data that the program writes.

Data record:

The basic unit of IBM Z storage on a DS8000, also known as a Count Key Data (CKD) record. Data records are stored on a track. The records are sequentially numbered starting with 0. The first record, R0, is typically called the track descriptor record and contains data that the operating system normally uses to manage the track. See also *count-key-data* and *fixed-block architecture*.

Data set FlashCopy:

For IBM Z hosts, a feature of FlashCopy that indicates how many partial volume FlashCopy relationships are active on a volume.

Data space l Hiperspace:

A data space or hiperspace contains only user data or user programs stored as data.

Data Set Command Line Interface (DS CLI): A software package that allows open systems hosts to invoke and manage Copy Services
functions as well as to configure and manage all storage units in a storage complex. The DS CLI is a full-function command set.

Data sharing:

The ability of multiple host systems to concurrently utilize data that they store on one or more storage devices. The storage system enables configured storage to be accessible to

any, or all, attached host systems. To use this capability, the host program must be designed to support data that it is sharing.

DC:

See *Direct Current.*

DC-UPS (Direct Current-Uninterruptible Power Supply:

Converts incoming AC line voltage to rectified AC, and contains an integrated battery subsystem.

Decrypt:

In Cryptographic Support, to convert ciphertext into plaintext. See also *encrypt*.

Decryption:

In computer security, the process of transforming encoded text or ciphertext into plaintext. The process of decoding data that has been encrypted into a secret format.
Decryption requires a secret key or password.

DELETE command (In UNIX):

Use the `DELETE` command to delete one or more data set entries or one or more members of a partitioned data set.

Demote:

To remove a logical data unit from cache memory. A storage server demotes a data unit to create room for other logical data units in the cache or because the logical data unit is not valid. The storage system must destage logical data units with active write units before they can be demoted. See also *destage*.

Dense Wavelength Division Multiplexing (DWDM):

Is a technology that puts data from different sources together on an optical fiber, with each signal carried at the same time on its own separate light wavelength. Using DWDM, up to 80 (and theoretically more) separate wavelengths or channels of data can be multiplexed into a lightstream transmitted on a single optical fiber. Each channel carries a Time Division Multiplexed (TDM) signal. In a system with each channel carrying 2.5 Gbps (billion bits per second), up to 200 billion bits can be delivered a second by the optical fiber. DWDM

is also sometimes called Wave Division Multiplexing (WDM).

Destage:

The storage system stages incoming data into cache and then destages it to disk.

Device:

For IBM Z, a disk drive.

Device Adapter (DA):

A physical component of DS8000 series that provides communication between the clusters and the storage devices. DS8000 series has eight device adapters that it deploys in pairs, one from each cluster. Device adapter pairing enables DS8000 series to access any disk drive from either of two paths, providing fault tolerance and enhanced availability.

Device address:

For IBM Z, the field of an ESCON device-level frame that selects a specific device on a control-unit image.

Device ID:

The unique two-digit hexadecimal number that identifies the logical device.

device interface card:

A physical subunit of a storage cluster that provides the communication with the attached device drive modules.

Device number:

For IBM Z, a four-hexadecimal-character identifier, for example 13A0, that the systems administrator associates with a device to facilitate communication between the program and the host operator. The device number is associated with a subchannel.

Device Support Facility (ICKDSF):

Is the utility used to install, initialize, and maintain IBM DASD. It can be run as a standalone job or under a system such as z/OS. 'ICK' is not an acronym for anything.

`DEVSER` command:

A z/OS command used to request a display of the status of DASD and tape devices. The response is a display of basic status information about a device, a group of devices, or storage control units. Because the `DEVSERV` command causes the system to issue an I/O request on paths to a device or devices, the resulting display reflects the current physical state of the path.

DFSMSdss:

See *Data Facility Storage Management Subsystem data set services utilities.*

DFSORT:

DFSORT is IBM's high-performance sort, merge, copy, analysis, and reporting product for z/OS.

DIMM:

See *Dual In-line Memory Module***.**

Direct Access Device Space Management (DADSM):

Performs the functions required to allocate or free space on a Direct Access Storage Device (DASD). The DADSM routines control allocation of space on DASD volumes, and provide information on volume contents on request. The information is kept by DADSM in its own data set which it maintains for each volume: the Volume Table Of Contents (VTOC).

Direct Access Storage Device (DASD):

1)A mass storage medium on which a computer stores data.
2)A disk device.

Direct Current (DC):

Is an electrical current, which flows consistently in one direction.

Disk Drive Module (DDM):

A Field Replaceable Unit (FRU) that consists of a single disk drive and its associated packaging.

Disk enclosure:

The DS8000 data disks are installed in enclosures called disk enclosures or storage

enclosures. These disk enclosures are installed in pairs.

Disk group:

A collection of 4 disk drives that are connected to the same pair of IBM Serial Storage adapters and can be used to create a RAID array. A disk group can be formatted as count key data or fixed block, and as RAID or non-RAID, or it can be left unformatted. A disk group is a logical assemblage of disk drives.

Disk Operating System (DOS):

Is an operating system that runs from a hard disk drive.

Disk scrubbing:

The DS8000 periodically reads all sectors on a disk. This reading is designed to occur without any interference with application performance. If Error Correction Code (ECC) detects correctable bad bits, the bits are corrected immediately. This ability reduces the possibility of multiple bad bits accumulating in a sector beyond the ability of ECC to correct them. If a sector contains data that is beyond ECC's ability to correct, RAID is used to regenerate the data and write a new copy onto a spare sector of the drive. This scrubbing process applies to drives that are array members and spares.

Disk Storage Feature Activation (DSFA):
The Data Storage Feature Activation (DSFA) application provides feature activation codes and license keys to technically activate functions acquired for IBM storage products.

Distributed Network Block Device (DNBD):
Uses UDP as its transport protocol, and thus supports multicasting, client-side caching, and server redundancy. It only supports RO exports.

Distributed ledger technology (DLT):

Allow their users to store and access information relating to a given set of assets and their holders in a shared database of either transactions or account balances. This information is distributed among users who could then use it to settle their transfers of, for example, securities and cash, without needing to rely on a trusted central validation system.

DNS:

See *Domain Name System*.

Domain:

1)That part of a computer network in which the data processing resources are under common control.
2)In TCP/IP, the naming system used in hierarchical networks.

Domain Name System (DNS):

In TCP/IP, the server program that supplies name-to-address translation by mapping domain names to Internet addresses. The address of a DNS server is the Internet address of the server that hosts the DNS software for the network.

DOS:

See *Disk Operating system.*

Dotted decimal notation:

A convention used to identify IP addresses. The notation consists of four 8-bit numbers written in base 10. For example, 9.113.76.250 is an IP address that contains the octets 9, 113, 76, and 250.

DRAM:

See *Dynamic Random Access Memory.*

Drawer:

A unit that contains multiple drive modules and provides power, cooling, and related interconnection logic to make the drive modules accessible to attached host systems.

Drive:

A drive can be either a magnetic drive or a Solid State Drive (SSD).
A field replaceable unit that consists of a single drive and its associated packaging.

DS CLI:

See *Data Set Command Line Interface.*

DS Network Interface (DSNI):

See *Enterprise Storage Server Network Interface.*

DS8000 series:

See *IBM DS8000*.

DS8000 Storage Management GUI:

See *IBM DS Storage Manager*.

Dual In-line Memory Module (DIMM):

Is a double SIMM (Single In-Line Memory Module). It's a module containing one or several Random Access Memory (RAM) chips on a small circuit board with pins that connect it to the computer motherboard. A DIMM has a 168-pin connector and supports 64-bit data transfer.

Duplex:

1)Regarding Copy Services, the state of a volume pair after Remote Mirror and Copy has completed the copy operation and the volume pair is synchronized.
2)In general, pertaining to a communication mode in which data can be sent and received at the same time.

Dynamic Address Translation (DAT):

When a virtual address is used by a CPU to access main storage, it is first converted by Dynamic Address Translation (DAT) to a real address and then by prefixing, to an absolute address.

Dynamic CHPID Management (DCM):
Provides the ability to have the system dynamically manage ESCON and FICON Bridge (FICON converter, or FCV) connected to DASD subsystems, based on the current work load and its service goals.

Dynamic Partition Manager (DPM):

Is a guided management interface in the HMC that can be used to define the IBM Z hardware and virtual infrastructure, including integrated dynamic I/O management that runs a KVM for IBM Z Systems environment.

Dynamic Random Access Memory (DRAM): A type of memory that is typically used for data or program code that a computer processor
needs to function. DRAM is a common type of Random Access Memory (RAM) used in Personal Computers (PCs), workstations and servers. Random access allows the PC processor to access any part of the memory

directly rather than having to proceed sequentially from a starting place. RAM is located close to a computer's processor and enables faster access to data than storage media such as hard disk drives and
solid-state drives.

Dynamic volume expansion:

The capability of the storage system to increase the capacity of host volumes up to a maximum size while online.

E

EAM:

See *Extent Allocation Method.*

EAV:

See *Extended Address Volume.*

Easy Tier:

Is a built-in dynamic data relocation feature that allows the host-transparent movement of data among the storage system resources. This feature significantly improves configuration flexibility and performance tuning and planning.

EC:

See *Engineering Change*.

ECC:

See *Error Correction Code.*

See *Elliptic Curve Cryptography.*

ECKD:

See *Extended Count Key Data*.

eDRAM:

See *Embedded DRAM.*

ElectroStatic Discharge (ESD):

An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

Elliptic Curve Cryptography (ECC):

Cryptographic capabilities that are designed to provide public key support for constrained digital environments.

Embedded DRAM (eDRAM):

Is Dynamic Random Access Memory (DRAM) integrated on the same die or Multi-Chip

Module (MCM) of an Application-Specific Integrated Circuit (ASIC) or microprocessor. eDRAM's cost-per-bit is higher when compared to equivalent standalone DRAM chips used as external memory, but the performance advantages of placing eDRAM onto the same chip as the processor outweigh the cost disadvantages in many applications.

Emergency Power Off (EPO):

A means of turning off power during an emergency, usually a switch.

EMIF:

See *ESCON Multiple Image Facility*.

Enclosure:

A unit that houses the components of a storage subsystem, such as a control unit, disk drives, and power source.

Encrypt:

In Cryptographic Support, to systematically scramble information so that it cannot be read without knowing the coding key. See also *decrypt*.

Encryption:

In computer security, the process of transforming data into an unintelligible form in such a way that the original data either cannot be obtained or can be obtained only by using a decryption process.

Encryption algorithm:

An algorithm that scrambles the data so that it becomes unreadable to someone who intercepts it.

Encryption group:

Indicates whether encryption is enabled (select 1) or disabled (select None) for ranks.

Enhanced Network Block Device (ENBD):

Is being pushed along by one active developer; there is a mailing list that sees a couple of messages a month. ENBD extends NBD adding an automatic restart if the connection is lost, authentication, and support for removable media.

Extended Address Volume (EAV):

This term refers to a volume with more than 65520 cylinders. Only 3390 Model A devices can be an EAV.

Engineering change:

An update to a machine, part, or program.

Enterprise Service Bus (ESB):

It implements a communication system between mutually interacting software applications in a service-oriented architecture (SOA)

Enterprise Systems Architecturel390 (ESAI390):

An IBM architecture for mainframe computers and peripherals. Processor systems that follow the ESA/390 architecture include the ES/9000 family. See also *z/Architecture*.

Enterprise Class configuration:

A high-density, high-performance storage

configuration that includes standard disk enclosures and high-performance flash enclosures and is optimized and configured for performance and throughput, by maximizing the number of device adapters and paths to the storage enclosures.

Enterprise Storage Server Network Interface (ESSNI):
Is the logical server that communicates with the DS GUI server and interacts with the two processor nodes of the DS8880. Also referred to as DS Network Interface (DSNI).

Enterprise Systems Connection (ESCON):
1)An IBM Z computer peripheral interface. The I/O interface uses IBM Z logical protocols over a serial interface that configures attached units to a communication fabric.
2)A set of IBM products and services that provide a dynamically connected environment within an enterprise.

Entropy Encoding:

Is a lossless data compression scheme that is independent of the specific characteristics of the medium.

EPS:

See *Emergency Power Off.*

ERDS:

See *Error-Recording Data Set*.

Error Correction Code (ECC):
Checks read or transmitted data for errors and corrects them as soon as they are found. ECC is similar to parity checking except that it corrects errors immediately upon detection.

Error-Recording Data Set (ERDS):
On IBM Z hosts, a data set that records data-storage and data-retrieval errors.
A
Service Information Message (SIM) provides the error information for the ERDS.

Error recovery procedure:
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record information on machine malfunctions.

ESB:

See *Enterprise Service Bus.*

ESCD:
See *ESCON Director*.

ESCON:
See *Enterprise System Connection*.

ESCON channel:
An IBM Z channel that supports ESCON protocols.

ESCON Director (ESCD):
An I/O interface switch that allows the interconnection of multiple ESCON interfaces in a distributed-star topology.

ESCON host systems:
IBM Z hosts that attach to the DS8000 series with an ESCON adapter. Such host systems run on operating systems that include z/OS, VSE, TPF, or versions of VM.

ESCON Multiple Image Facility (EMIF):
For IBM Z, a function that enables LPARs to share an ESCON channel path by providing

each LPAR with its own channel-subsystem image.

EsconNet:
In the DS8000 Storage Management GUI, the label on a pseudo host icon that represents a host connection that uses the ESCON protocol and that is not completely defined onDS8000 series. See also *pseudo host* and *access-any mode*.

ESD:

See *ElectroStatic Discharge*.

ESE:

See *Extent Space-Efficient*.

ESSNet:
See *IBM Enterprise Storage Server Network*.

ESSNI:
See *Enterprise Storage Server Network Interface.*

Evaluation Assurance Level (EAL):
The Evaluation Assurance Level (EAL1 through EAL7) of an IT product or system is a numerical grade assigned following the completion of a Common Criteria security evaluation, an international standard in effect since 1999. The increasing assurance levels reflect added assurance requirements that must be met to achieve Common Criteria certification. The intent of the higher levels is to provide higher confidence that the system's principal security features are reliably implemented. The EAL level does not measure the security of the system itself, it simply states at what level the system was tested.

Extended Count Key Data (ECKD):
An extension of the Count Key Data (CKD) architecture.

Extended Addressing Space (EAS):
On an extended address volume, this term refers to cylinders with addresses that are equal to or greater than 65,536. These cylinder addresses are represented by 28-bit cylinder numbers.

Extended Address Volume (EAV):
A volume with more than 65,520 cylinders. An extended address volume increases the amount of addressable DASD storage per volume beyond 65,520 cylinders by changing how tracks on ECKD (Extended Count Key Data) volumes are addressed.

Extent:
A continuous space on a disk that is occupied by or reserved for a particular data set, data space, or file. The unit of increment is a track. See also *multiple allegiance* and *parallel access volumes*.

Extent Allocation Method (EAM):
Defines how volumes extents are allocated on the ranks in the Extent Pool.

Extent pool:
A group of extents. See also *extent*.

Extent Space-Efficient:
A thin-provisioning method in which capacity is allocated in a performance efficient manner on a per extent basis in pool or ESE repository if one is created on an as-needed basis.

Extent Space Efficient (ESE) volumes:
Are the actual thin provisioned volumes that can be used by host applications.The dynamic allocation increments for ESE logical volumes is based on the same existing 1 GB extents used for standard volumes.

F

Fabric:
In Fibre Channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple Fibre Channel switches are interconnected, they are said to be *cascaded*.

Failback:
Pertaining to a cluster recovery from failover following repair. See also *failover*.

Failover:
Pertaining to the process of transferring all control to a single cluster when the other cluster in the storage system fails. See also *cluster* and *failback*.

Fast File System (FFS):
FFS invented cylinder groups, which break the disk up into smaller chunks, with each group

having its own inodes and data blocks.

Fast write:

A write operation at cache speed that does not require immediate transfer of data to a disk drive. The subsystem writes the data directly to cache, to nonvolatile storage, or to both. The data is then available for destaging. A fast-write operation reduces the time an application must wait for the I/O operation to complete.

FBA:

See *Fixed-Block Architecture*.

FC:

See *feature code*.
Note: *FC* is a common abbreviation for Fibre Channel in the industry, but the DS8000 customer documentation library reserves *FC* for feature code.

FC:

See *Fibre Channel.*

FC-AL:

See *Fibre Channel Arbitrated Loop*.

FCP:

See *Fibre Channel Protocol*.

FCS:

See *Fibre Channel standard*.

Feature Code (FC):

A code that identifies a particular orderable option and that is used by service personnel to process hardware and software orders. Individual optional features are each identified by a unique feature code.

Fibre Channel (FC):

A data-transmission architecture based on the ANSI Fibre Channel standard, which supports full-duplex communication. DS8000 series supports data transmission over fiber-optic cable through its Fibre Channel adapters. See also *Fibre Channel Protocol* and *Fibre Channel standard*.

Fibre Channel Arbitrated Loop (FC-AL):
An implementation of the Fibre Channel Standard that uses a ring topology for the communication fabric. Refer to American National Standards Institute (ANSI) X3T11/93-275. In this topology, two or more Fibre Channel end points are interconnected through a looped interface. This topology
directly connects the storage system to an open systems host without going through a fabric switch.

Fibre Channel Connection (FICON):

A Fibre Channel communications protocol that is designed for IBM mainframe computers and peripherals. It connects the storage system to one or more IBM Z hosts using a FICON z/OS channel either directly or through a FICON switch.

Fibre Channel Protocol (FCP):

A protocol used in Fibre Channel communications with five layers that define how Fibre Channel ports interact through their physical links to communicate with other ports. FCP (Fibre Channel Protocol) supports access to Small Computer System Interface (SCSI) peripheral devices.

Fibre Channel Standard (FCS):

An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. The protocol has two layers. The IP layer defines basic interconnection protocols. The upper layer supports one or more logical protocols (for example, FCP for SCSI command protocols and SBCON for IBM Z command protocols). Refer to American National Standards Institute (ANSI) X3.230-199x.

Fibre Channel Switched Fabric (FC-SF):
An implementation of the Fibre Channel Standard that connects the storage system to
one or more open systems hosts through a fabric switch or connects one or more z/OS
hosts that run LINUX on a Fibre Channel Protocol z/OS channel.

FICON:
See *Fibre Channel CONnection*.

FiconNet:
In the DS8000 Storage Management GUI, the label on a pseudo host icon that represents a host connection that uses the FICON protocol and that is not completely defined on DS8000 series. See also *pseudo host* and *access-any mode*.

Field Replaceable Unit (FRU):
An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit might contain other field replaceable units.

File Transfer Protocol (FTP):
In TCP/IP, an application protocol used to transfer files to and from host computers. See also *Transmission Control Protocol/Internet Protocol*.

Firewall:
A protection against unauthorized connection to a computer or a data storage system. The protection is usually in the form of software on a gateway server that grants access to users who meet authorization criteria.

Fixed Block Architecture:
An architecture for logical devices that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size). The subsystem can access them independently.

Flag parameter:
An integer flag that indicates whether the match needs to be performed on the supplied project name or number.

Flash cards:
Are high2-IOPS (Input/Output Operations Per Second) class enterprise storage devices that are targeted at Tier 0, I/O-intensive workload
applications that can use a high level of fast-access storage.

FlashCopy:
FlashCopy is an IBM feature supported on various IBM storage devices that made it possible to create, nearly instantaneously, point-in-time snapshot copies of entire logical volumes or data sets. The copies are immediately available for both read and write access.

FlashCopy relationship:
A mapping of a FlashCopy source volume and a FlashCopy target volume that allows a point-in-time copy of the source volume to be copied to the target volume. FlashCopy relationships exist from the time that you initiate a FlashCopy operation until the storage system copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is persistent.

FlashCopy SE:
An optional feature of DS8880 series that allocates storage space on an 'as-needed' basis and uses only the required number of tracks to write changed data during the lifetime of the FlashCopy relationship.

Flash Raid Adapter:
An adapter that manages external I/O interfaces that use Fibre Channel protocols

for host-system attachment. It is also used for replicating data between storage systems.

Flexible Service Processor (FSP):
Firmware that provides diagnostics, initialization, configuration, run-time error detection, and correction. FSP is what connects the managed system to the Hardware Management Console (HMC).

Floating spare:
When a DDM fails and the data it contained is rebuilt onto a spare, then when the disk is replaced, the replacement disk becomes the spare. The data is not migrated to another DDM, such as the DDM in the original position the failed DDM occupied. The DS8000

microcode takes this idea one step further. It might choose to allow the hot spare to remain where it has been moved, but it can instead choose to migrate the spare to a more optimum position. This will be done to better balance the spares across the DA pairs, the loops, and the disk enclosures.

FMID:

See *Function Modification Identifier.*

Frame:
The hardware support structure, covers, and all electrical parts mounted therein that are packaged as one entity for shipping.

`FREE` command (In UNIX):
Use the `FREE` command to release (deallocate) previously allocated data sets or Hierarchical File System (HFS) files that you no longer need. You can also use this command to change the output class of SYSOUT data sets to delete attribute lists, and to change the data set disposition specified with the `ALLOCATE` command. There is a maximum number of data sets that can be allocated to you at any one time.

FRU:
See *Field Replaceable Unit*.

FSP:
See *Flexible Service Processor.*

FTP:
See *File Transfer Protocol*.

Full duplex:
See *duplex*.

Full Disk Encryption (FDE):
Is the encryption of all data on a disk drive, including the program that encrypts the bootable operating system partition. It is performed by disk encryption software or hardware that is installed on the drive during manufacturing or from an additional software driver. FDE converts all device data into a form that can be only understood by the one who has the key to decrypt the encrypted data. An authentication key is used to reverse

conversion and render the data readable. FDE prevents unauthorized drive and data access.

Fully provisioned:
The volume capacity is entirely allocated at the time the volume is created. In this case, the host to which the fully provisioned volume is attached owns the full capacity, therefore consuming unused storage in the back-end system.

Function Modification Identifier (FMID):
An identifier that is used to identify a separate product or function of a product.

Fuzzy copy:
A function of the Global Copy feature wherein modifications to the primary logical volume are performed on the secondary logical volume at a later time. The original order of update is not strictly maintained. See also *Global Copy*.

G

GB:
See *gigabyte*.

GiB:

See *gibibyte*.

GDPS:

See *Geographically Dispersed Parallel Sysplex*.

Geographically Dispersed Parallel Sysplex (GDPS):

Is a multi-site or single-site end to end application availability solution that provides the capability to manage remote copy configuration and storage subsystems (including IBM TotalStorage Enterprise Storage Server) to automate Parallel Sysplex operation tasks and perform failure recovery from a single point of control. GDPS helps automate recovery procedures for planned and unplanned outages to provide near-continuous availability and disaster recovery capability.

Gigabyte (GB):

A base-10 unit of measurement equal to 1,000,000,000 bytes (10A9). A *decimal* gigabyte (GB) is used as a measure of capacity. A *binary* gigabyte (or gibibyte [GiB]) is used as a measure of memory.

Gibibyte (GiB):

A base-2 unit of measurement equal to 1,073,741,824 bytes (2A30).
Note: A GiB is used as a measure of memory and is also known as a *binary* gigabyte.

Gigapack:

Connects to the drive adapter (in DS8000) through Fibre Channel protocol and converts to SAS protocol through the control card switch in the RAID adapter.

Global Copy:

An optional capability of the DS8000 remote mirror and copy feature that maintains a fuzzy copy of a logical volume on the same DS8000 storage system or on another DS8000 storage system. In other words, all modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume at a later point in time. The original order of update is not strictly maintained. See also *Remote Mirror and Copy* and *Metro Mirror*.

Global Mirror:

An optional capability of the remote mirror and copy feature that provides a 2-site extended distance remote copy. Data that is written by the host to the storage system at the local site is automatically maintained at the remote site. See also *Metro Mirror* and *Remote Mirror and Copy*.

Global Network Block Device (GNBD):

Is the basis for GFS (the Global file system).

Global Resource Serialization (GRS):

Is the component within the IBM z/OS operating system responsible for enabling fair access to serially reusable computing resources, such as datasets and tape drives or virtual resources, such as lists, queues, and control blocks.

Group:

In DS8000 documentation, a nickname for two different kinds of groups, depending on the context. See also *disk pack* or *Copy Services server group*.

GRUB:

GNU GRUB (short for GNU GRand Unified Bootloader) is a boot loader package from the GNU Project. GRUB is the reference implementation of the Free Software Foundation's Multiboot Specification, which provides a user the choice to boot one of multiple operating systems installed on a computer or select a specific kernel configuration available on a particular operating system's partitions.

Guests (VM):

A guest virtual machine (guest VM) is the software component of a virtual machine (VM), an independent instance of an operating system (called a guest operating system) and its associated software and information. A VM guest can be a Linux, z/OS, z/VSE, or another z/VM operating system.

GUI (graphical user interface):

A way of communicating with a computer by manipulating icons (pictures) and windows with a mouse. A device that makes a program more user friendly.

H

HACMP:

See *High Availability Cluster Multi-Processing*.

Hard disk drive:

1)A storage medium within a storage server used to maintain information that the storage server requires.
2)A mass storage medium for computers that is typically available as a fixed disk (such as the disks used in system units of personal computers or in drives that are external to a personal computer) or a removable cartridge.

Hardware:

Is the collection of physical parts of a computer system.

Hardware Configuration Definition (HCD):

Defines the I/O configurations to both the software and hardware from a single, interactive interface. HCD is used to create an Input/Output Definition File (IODF).

Hardware Management Console (HMC):

A system that controls managed systems, including the management of logical partitions and use of capacity Upgrade on Demand. Using service applications, the HMC communicates with managed systems to detect and consolidate information, which is then sent to IBM for analysis.

Hardware service manager:

An option on a IBM i host that enables the user to display and work with system hardware resources and to debug input-output processors (IOP), input-output adapters (IOA), and devices.

HCD:

See *Hardware Configuration Definition*.

hdisk:

An AIX term for storage space.

Heartbeat:

A status report sent at regular intervals from the DS8000 storage system. The service provider uses this report to monitor the health of the call home process. See also *call home*, and *remote technical assistance information network*.

`HELP` command (In UNIX):

Use the **`HELP`** command to obtain information about the function, syntax, and operands of commands and subcommands, as well as information about certain messages.

Hierarchical storage management:

A function in storage management software, such as IBM Spectrum Control or Data Facility Storage Management Subsystem/MVS (DFSMS/MVS), that automatically manages free space based on the policy that the storage administrator sets.

Hierarchical File System (HFS):

HFS is a proprietary file system developed by Apple Inc. for use in computer systems running Mac OS.

High Availability Cluster Multi-Processing (HACMP):

Is an older term for PowerHA (High Availability). PowerHA is a special piece of software, which can provide redundancy and high availability to meet the needs in case of a system failure by having another system

immediately take over.

High Performance FICON for IBM Z (zHPF): Is an enhancement of the FICON channel architecture. You can reduce the FICON channel I/O traffic impact by using zHPF with the FICON channel, the z/OS operating system, and the control unit. zHPF allows the control unit to stream the data for multiple commands back in a single data transfer section for I/Os that are initiated by various access methods, which improves the channel throughput on small block transfers.

High-Performance Flash Enclosure (HPFE): Contains flash cards, which are PCIe-connected to the I/O enclosures.

Hipersocket:

Mainframe HiperSockets is a technology that provides high-speed TCP/IP connectivity within a central processor complex. It eliminates the need for any physical cabling or external networking connection between servers running in different LPARs.

Hop:

Interswitch connection. A hop count is the number of connections that a particular block of data traverses between source and destination. For example, data traveling from one hub over a wire to another hub traverses one hop.

Host:

See *host system*.

Host Adapter (HA):

A physical subunit of a storage server that provides the ability to attach to one or more host I/O interfaces.

Host name:

The Internet address of a machine in the network. The host name can be entered in the host definition as the fully qualified domain name of the attached host system, such as mycomputer.city.company.com, or as the subname of the fully qualified domain name, for example, mycomputer. See also *host system*.

Host processor:

A processor that controls all or part of a user application network. In a network, the processing unit in which the data communication access method resides. See also *host system*.

Host system:

A computer, either of the mainframe (for example, IBM Z) or of the open-systems type, that is connected to DS8000 series. Hosts are connected through ESCON, FICON, or Fibre Channel interfaces.

HMC:

See *Hardware Management Console*.

HTTP:

See *Hypertext Transfer Protocol.*

Huffman Coding:

is a lossless data compression algorithm. The idea is to assign variable-length codes to input characters, lengths of the assigned codes are based on the frequencies of corresponding characters.

HyperPAV:

An optional licensed function that you can use in conjunction with the Parallel Access Volumes (PAV) function. IBM HyperPAV associates the volumes with either an alias address or a specified base logical volume number. When a host system requests IBM HyperPAV processing and the processing is enabled, aliases on the logical subsystem are placed in an IBM HyperPAV alias access state on all logical paths with a given path group ID. IBM HyperPAV is only supported on FICON channel paths.

HyperSwap:

The HyperSwap technology enables the host to transparently switch an application's I/O operations to the secondary Metro Mirror volumes, provided physical connectivity exists between the host and the secondary storage subsystem. This affords the ability to provide continuous operations from a single site or from multiple locations within metro distances. By implementing HyperSwap, disk failures and maintenance functions can be endured without incurring any interruption to the application service.

Hypertext Transfer Protocol (HTTP):

Is an application protocol for distributed, collaborative, and hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web.

Hypervisor:

Is a piece of computer software, firmware, or hardware that creates and runs virtual machines. A computer on which a hypervisor runs one or more virtual machines is called a host machine, and each virtual machine is called a guest machine. The hypervisor presents the guest operating systems with a virtual operating platform and manages the execution of the guest operating systems.

I

IaaS:

See *Infrastructure as a Service.*

IBF:

See *Internal Battery Feature*.

IBM i:

The IBM licensed program that is the integrated operating system for Power Systems servers. It integrates such functions as relational database, security, web services, networking, and storage management capabilities. The predecessor to IBM i was i5/OS, which was preceded by Operating System/400 (OS/400).

IBM (International Businesses Machine):

The brand name used to identify storage products from IBM, including DS8000 series. See also *DS8000* and *DS Storage Manager*.

IBM DS8000:

A member of the IBM Resiliency Family of storage servers and attached storage devices (drive modules). The DS8000 series storage product delivers high-performance, fault-tolerant storage and management of enterprise data, affording access through multiple concurrent operating systems and communication protocols. High performance is provided by multiple symmetrical multiprocessors, integrated caching, RAID support for the drive modules, and disk access through a high-speed serial storage architecture interface.

IBM DS8880 Series (DS8884, DS8886, DS8888):

New IBM DS8880 family of data systems architected and built for the cognitive business. IBM DS8884: Business class system. Enables organizations to overcome storage challenges with advanced, easy-to-use operations and 24x7 availability for running critical workloads, either as a dedicated platform for consolidated systems or for multiple platforms. Delivered within an affordable, flexible, and space-saving package. Up to 256 GB cache, 64 x 16 GB Fibre Channel/FICON ports and up to 768 HDD/SSD drives, plus 120 flash cards.
IBM DS8886: Enterprise class system. Helps accelerate mission-critical applications, backed by 24x7 availability, and superior functionality, all provided in an easily scalable package. Up to 2 TB total system memory, 128 x 16 GB Fibre Channel/FICON ports and up to 1,536 HDD/SSD drives, plus 240 flash cards.
IBM DS8888: Enterprise class system. Delivers mission-critical performance and lower latency for applications with up to 4.5

times better performance through an all-flash configuration. Up to 2 TB total system memory, 128 x 16 GB Fibre Channel/FICON ports and up to 480 flash cards.

IBM DS CLI:

The Command-Line Interface (CLI) that works with DS8000 storage subsystems.

IBM DS Storage Manager (DS8000 Storage Management GUI):

Software with a web-browser interface for configuring DS8000 series.

IBM MQ:

IBM MQ is a family of network software products that IBM launched for the first time as an IBM product in December 1993. It was originally called MQSeries, and was renamed WebSphere MQ in 2002 to join the suite of WebSphere products. In April 2014, it was renamed IBM MQ. The products that are included in the MQ family are IBM MQ, IBM MQ Advanced, IBM MQ Appliance, and IBM MQ for z/OS.

IBM Multipath Subsystem Device Driver (SDD):

IBM software that provides multipath configuration support for a host system that is attached to storage devices. SDD provides enhanced data availability, dynamic input/output load balancing across multiple paths, and automatic path failover protection.

IBM POWER8 Processor:

POWER8 is a family of superscalar symmetric multiprocessors based on the Power Architecture.
Systems based on POWER8 became available from IBM in June 2014.

IBM Resiliency Family:

A set of hardware and software features and products, as well as integrated software and services that are available on the DS8000 series and the IBM TotalStorage Enterprise Storage Server, Models 750 and 800.

IBM Spectrum Control:

An interface that allows administrators to configure, manage, and monitor the performance of SAN storage devices from a single console.
IBM Enterprise Storage Server Network (ESSNet)
A private network providing web browser access to the Enterprise Storage Server. IBM installs the ESSNet software on an IBM

workstation called the IBM TotalStorage ESS Master Console, supplied with the first ESS delivery.

IBM Z:

The IBM family of products, which emphasizes near-zero downtime and includes System z10 and System z10s.

ICKDSF (Device Support Facility):

The z/OS ICKDSF utility performs functions needed for the installation, use, and maintenance of IBM direct-access storage devices (DASD). Also used to perform service functions, error detection, and media maintenance. The ICKDSF utility is used primarily to initialize disk volumes. At a minimum, this process involves creating the disk label record and the volume table of contents (VTOC). ICKDSF also can scan a volume to ensure that it is usable, can reformat all the tracks, can write home addresses, as well as other functions.

ICF:

See *Internal Coupling Facility.*

ICON:

A picture representing something that exists on the computer.

IEBCOMPR:

IEBCOMPR is a z/OS data set utility that is used to compare two sequential data sets,

two partitioned data sets, or two Partitioned Data Sets Extended (PDSE) at the logical record level to verify a backup copy.

IEBCOPY:

IEBCOPY is a z/OS data set utility that is used to copy or merge members between one or more partitioned data sets, or Partitioned Data Sets Extended (PDSE), in full or in part.

IEBDG:

IEBDG is a z/OS data set utility that is used to provide a pattern of test data to be used as a programming debugging aid.

IEBGENER:

The IEBGENER utility is a z/OS copy program that is part of the operating system. It is used to copy a sequential data set, a member of a Partitioned Data Set (PDS), or PDSE.

IEBIMAGE:

IEBIMAGE is a z/OS data set utility that creates and maintains specific printer type modules and stores them in a library.

IEBPTPCH:

IEBPTPCH is used to print or punch all, or selected portions of a sequential data set or PDSE.

IEBUPTE:

IEBUPTE is used to create or modify sequential or partitioned data sets, or PDSE.

IEFBR14:

IEFBR14 is a dummy program, normally inserted in JCL when the only desired action is allocation or deletion of data sets.

IEHINITT:

EHINITT is a z/OS system utility used to place standard volume label sets onto any number of magnetic tapes mounted on one or more tape units.

IEHLIST:

IEHLIST is a z/OS system utility used to list entries in the directory of one or more partitioned data sets or PDSEs, or entries in an indexed or non-indexed volume table of contents. Any number of listings can be requested in a single execution of the program.

IEHMOVE:

IEHMOVE is a z/OS system utility used to move or copy logical collections of operating system data.

IEHPROGM:

IEHPROGM is a z/OS system utility that is used to modify system control data and to maintain data sets at an organizational level.

IFL:

See *Integrated Facility for Linux.*

IFHSTATR:

IFHSTATR is a system utility that formats and prints information from Type 21 SMF (system management facilities) records. These records provide error statistics by volume (ESV) data.

image:

See *storage image*.

IML:

See *Initial Microcode Load*.

Information Management System (IMS): Is a database and transaction management system.

Information Management System transaction manager (IMS TM):

Is a message-based transaction processor.

Information Technology (IT):

Is the use of computers to store, retrieve, transmit, and manipulate data, or information, often in the context of a business or other enterprise.

Integrated Coupling Facility (ICF):

These processors run only Licensed Internal

Code. They are not visible to normal operating systems or applications. A coupling facility is, in effect, a large memory scratch pad used by multiple systems to coordinate work. ICFs must be assigned to LPARs that then become coupling facilities.

Infrastructure as a Service (IaaS):

Is a form of cloud computing that provides virtualized computing resources over the Internet. IaaS is one of three main categories of cloud computing services, alongside Software as a Service (SaaS) and Platform as a Service (PaaS).

Initial Microcode Load (IML):

The action of loading microcode for a computer into that computer's storage.

Initial Program Load (IPL):
The action of loading software into a computer, typically an operating system that controls the computer.

Initiator:

A SCSI device that communicates with and controls one or more targets. Contrast with *target*.

Inode:

An inode is a data structure on a filesystem on Linux and other UNIX-like operating systems that stores all the information about a file except its name and its actual data. A data structure is a way of storing data so that it can be used efficiently.

InputIOutput (IIO):

Pertaining to (a) input, output, or both or (b) a device, process, or channel involved in data input, data output, or both.

IIO Adapter:

A generic term for an electronic circuit, expansion card, or plug-in module that accepts input and generates output in a particular format. The 'adapter' part of the term means that a conversion of the data format and electronic timing takes place between the input/output streams and the internal computer circuits.

InputIOutput Configuration Data Set (IOCDS):

A configuration definition built by the I/O Configuration Program (IOCP) and stored on disk files associated with the processor controller.

InputIOutput Definition File (IODF):
Created by HCD (Hardware Configuration Definition) and contains information about the
I/O configuration, such as: Operating system data, Switch data, Device data, including EDT definition, Processor data, Partition data, Channel path data, Control unit data, and Channel subsystem data.

IIO enclosure:

The I/O enclosures hold the adapters and provide connectivity between the adapters and the processors. Both device adapters and host adapters are installed in the I/O enclosure.

In-stream procedure:

Are procedures whose JCL statements are placed within the job executing them. The beginning of an in-stream procedure must be marked by a PROC statement, its ending by a PEND statement. In-stream procedures must be defined before they can be used, meaning the procedure definition must precede its invocation.

Integrated Facility for Linux (IFL):

This is a normal processor with one or two instructions disabled that are used only by z/OS. Linux does not use these instructions and can be executed by an IFL. Linux can be executed by a CP as well. The difference is that an IFL is not counted when specifying the model number of the system. This can

make a substantial difference in software costs.

Intelligent Resource Director:

Intelligent Resource Director (IRD) is software that automates the management of CPU resources and certain I/O resources.

Intelligent Write Caching (IWC):

Improves performance through better write cache management and a better destaging of order of writes.

Interactive mode:

The interactive command mode provides a history function that makes repeating or checking prior command usage easy to do. Log on to the DS CLI application at the directory where it is installed, and begin using the DS CLI commands and parameters.

Interactive System Productivity Facility (ISPF):

Is a software product for the z/OS operating system that runs on IBM mainframes. ISPF primarily provides an IBM 3270 terminal interface with a set of panels. Each panel may include menus and dialogs to run tools on the underlying Time Sharing Option (TSO). ISPF is frequently used to manipulate z/OS data sets from its Program Development Facility named ISPF/PDF, where PDF refers to Program Development Facility.

Interface cards:

Provide the connection between storage devices and the internal processors and memory.

Interleave:

To automatically create two striped partitions across the drives in a RAID-5 array, both of which use the Count-Key-Data (CKD) record format.

Internal Battery Feature (IBF):

The Internal Battery Feature (IBF) is an optional feature on many of the IBM Z family processors. The IBF provides a local uninterrupted power source and further enhances the robustness of the power design present in the mainframe and increases a mainframe's immunity to power line disturbance. It provides battery backup power to preserve processor data during a loss of power on all power feeds from the computer room. The IBF can hold power briefly during a brownout, or for orderly shutdown if there is a longer outage. The IBF will not be available on the IBM z14 Model ZR1 which introduces customers to another consideration when planning a new build or upgrade to this machine.

Internal Coupling Facility:

Provides a cost effective means for getting started in DB2 data sharing. Additionally, if the ICFs are configured with internal links, there can be a performance benefit over external coupling facilities.

Internet Protocol (IP):

In the Internet suite of protocols, a protocol without connections that routes data through a network or interconnecting networks and acts as an intermediary between the higher protocol layers and the physical network. The upper layer supports one or more logical protocols (for example, a SCSI-command protocol and IBM Z command protocol). Refer to ANSI X3.230-199*x*. The IP acronym is the IP in TCP/IP. See also *Transmission Control Protocol/Internet Protocol*.

Invalidate:

To remove a logical data unit from cache memory because it cannot support continued access to the logical data unit on the device. This removal might be the result of a failure within the storage server or a storage device that is associated with the device.

IIO:

See *Input/Output*.

IIO Adapter (IOA):

An input-output adapter on the PCI bus.

IOCDS:

See *Input/Output Configuration Data Set*.

IOCP (IIO Configuration Program):

A program that defines to a system all the available I/O devices and channel paths.

IIO interface:

An interface that enables a host to perform read and write operations with its associated peripheral devices.

InputIOutput Operations Per Second (IOPS): Is the standard unit of measurement for the maximum number of reads and writes to
non-contiguous storage locations.

IIO ports:

It allows the software drivers to communicate with hardware devices on a computer.

IIO Priority Manager (IOPM):

Constantly monitors and balances system resources to help applications meet their performance targets automatically, without operator intervention. Allows increased priority for Critical I/O. The IO Priority manager extends the IBM Z System WorkLoad Manager functionality to include storage. With this feature, the system administrator can use zWLM to manage all computing resources.

IIO priority queuing:

Allows the DS8000 series to use I/O priority information provided by the z/OS Workload Manager to manage the processing sequence of I/O operations.

IOPS:

See *Input/Output Operations Per Second.*

IP:

See *Internet Protocol*.

IPL:

See *Initial Program Load*.

IRD:

See *Intelligent Resource Director*.

ISPF Shell (ISHELL):

The `ISHELL` command invokes the ISPF panel interface to z/OS UNIX System Services. ISHELL is a good starting point for users familiar with TSO and ISPF who want to use z/OS UNIX.

IT:

See *Information Technology.*

IWC:

See *Intelligent Write Caching*.

J

Java:

Is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible.

Java Virtual Machine (JVM):

A software implementation of a processor that runs compiled Java code (applets and applications).

Job Control Language (JCL):

JCL is the language used by a batch job to request resources and services from the operating system.

Job Entry System (JES):

In the z/OS operating system, JES manages the input and output job queues and data.

Each JES2 processor controls its own job input, job scheduling, and job output processing.

Centralized control over processing through a

single global JES3 processor, which does job selection, scheduling, and device allocation on the other JES3 systems.

JVM:

See *Java Virtual Machine*.

K

KB:

See *kilobyte*.

Kernel:

The kernel is the central module of an operating system. It is the part of the operating system that loads first, and it remains in main memory.

Kernel-based Virtual Machine (KVM):

Is a virtualization infrastructure for the Linux kernel that turns it into a hypervisor. It was merged into the Linux kernel mainline in kernel version 2.6.20, which was released on February 5, 2007. KVM requires a processor with hardware virtualization extensions.

See *kilobyte*.

Key field:

The second (optional) field of a count key data record. The key length is specified in the count field. The key length determines the field length. The program writes the data in the key field and uses the key field to identify or locate a given record. The subsystem does not use the key field.

Keyword operand (In UNIX):

Keyword operands are specific names or symbols that are recognized by the system. Therefore, keyword operands can be entered in any order following the positional operands. In the upcoming command descriptions, keyword operands are shown in uppercase characters. You can specify values with some keyword operands. Enclose the values in parentheses following the operand.

Kilobyte (KB):

1)For processor storage, real, and virtual storage, and channel volume, 2^{10} or 1024 bytes.
2)For disk storage capacity and communications volume, 1000 bytes.

Korn shell:

Interactive command interpreter and a command programming language.

L

Large Form Factor (LFF):

3.5-inch hard disk drives (HDDs). The measurement represent the approximate diameter of the platter within the drive enclosures.

Large Volume Support (LVS):

Expands the CKD (Count Key Data) volumes to 65,520 cylinders using the existing 16-bit cylinder addressing.

LAN:

See *Local Area Network*.

LBA:

See *Logical Block Address*.

LCU:

See *Logical Control Unit.*

LDAP:

See *Lightweight Directory Access Protocol.*

Least Recently Used (LRU):

The LRU caching scheme is to remove the least recently used frame when the cache is full and a new page is referenced which is not there in cache.

LED:

See *Light-Emitting Diode*.

Legacy view:

A hardware or software view that has been superseded.

LFF:

See *Large Form Factor.*

Libvirt:

Is an open source API, daemon, and management tool for managing platform virtualization. It can be used to manage KVM, Xen, VMware ESX, QEMU, and other virtualization technologies. These APIs are widely used in the orchestration layer of hypervisors in the development of a cloud-based solution.

LIC:

See *License Internal Code.*

LICCC:

See *Licensed Internal Code Configuration Control.*

License key:

Is a data string that verifies authorized software product access. This type of software security helps prevent software piracy and gives organizations the ability to protect their software from unauthorized copying or sharing by unlicensed users.

License Internal Code (LIC):

Software that enables the hardware on a server. It is controlled by the System Flexible Service Processor (FSP). It initializes the hardware so that a system boots up and operates correctly and provides the interface for the operating system to interact with the hardware.

Licensed Internal Code Configuration Control (LICCC):

Provides for server upgrades without hardware changes by activation of additional (previously installed) unused capacity.

Licensed Machine Code (LMC):

Microcode that IBM does not sell as part of a machine, but licenses to the customer. LMC is implemented in a part of storage that is not addressable by user programs. Some IBM products use it to implement functions as an alternate to hard-wired circuitry.

Lightweight Directory Access Protocol (LDAP):

Defines a standard method to access and update information in a directory.

Light-Emitting Diode (LED):

A semiconductor chip that displays visible or infrared light when activated.

Link address:

On an ESCON interface, the portion of a source or destination address in a frame that ESCON uses to route a frame through an ESCON director. ESCON associates the link address with a specific switch port that is on the ESCON director. Equivalently, it associates the link address with the channel subsystem or control unit link-level functions that are attached to the switch port.

Link-level facility:

The ESCON hardware and logical functions of a control unit or channel subsystem that allow communication over an ESCON write interface and an ESCON read interface.

Linux:

Is system software that manages computer hardware and software resources and provides common services for computer programs.

LinuxONE:

Built on IBM Z technology and designed for Linux-only environments. The LinuxONE Emperor, which is built on the IBM z13 mainframe and its z13 CPU, and its little brother, Rockhopper, which uses the older z12 processor.

`LISTALC` command (In UNIX):

Use the `LISTALC` command to obtain a list of the currently allocated data sets. `LISTALC` without operands displays a list of all currently

allocated data set names.

`LISTCAT` command (In UNIX):

Use the `LISTCAT` command to list entries from a catalog. The entries listed can be selected by name or entry type, and the fields to be listed for each entry can additionally be selected.

`LISTDS` command (In UNIX):

Use the `LISTDS` command to have the attributes of specific data sets displayed at your terminal. The `LISTDS` command works differently for VSAM than for non-VSAM data sets. A VSAM data set causes the `LISTDS` command to display only the data set organization, which is VSAM. Use the `LISTCAT` command to obtain more information about a VSAM data set.

Local Area Network (LAN):

A computer network located on a user's premises within a limited geographic area.

Log Structured File System (LFS):

LFS is a file system in which data and metadata are written sequentially to a circular buffer, called a log.

Logical Block Address (LBA):

The address assigned by DS8000 series to a sector of a disk.

Logical Control Unit (LCU):

An LCU is equivalent to a Logical SubSystem (LSS). Like an LSS, an LCU can have a maximum of 256 logical devices or volumes.

Logical device:

The facilities of a storage server (such as DS8000 series) associated with the processing of I/O operations directed to a single
host-accessible emulated I/O device. The associated storage is referred to as a logical volume. The logical device is mapped to one or more host-addressable units, such as a device on IBM Z I/O interface or a logical unit on a SCSI I/O interface, such that the host initiating I/O operations to the I/O-addressable unit interacts with the storage on the associated logical device.

Lightweight Directory Access Protocol (LPAP):

Is a protocol, which makes directory information available.

Logical Partition (LPAR):

For IBM Z, a set of functions that create the programming environment in which more than one Logical PARtition (LPAR) is established on

a processor. An LPAR is conceptually like a virtual machine environment except that the LPAR is a function of the processor. Also, the LPAR does not depend on an operating system to create the virtual machine environment. (DS8000 series only).

Logical path:

1)The relationship between a channel image and a control-unit image that designates the physical path to be used for device-level communications between these images. The logical path is established as part of the channel and control-unit initialization procedures by the exchange of link-level frames.
2)With the Remote Mirror and Copy feature, the relationship between a source logical subsystem (LSS) and a target LSS that is created over a physical path through the interconnection fabric that is used for Remote Mirror and Copy functions. An LSS is a primary control unit, which performs the functions of a channel image.

Logical Subsystem (LSS):

A topological construct that consists of a group of up to 256 logical devices. A DS8000 storage system can have (if CDK only) up to 32
CKD-formatted logical subsystems (8192 CKD logical devices) or (if FBA only) up to 32

fixed-block logical subsystems (8192 fixed-block logical devices). If mixed CKD and FBA, DS8000 series can have up to 16 CKD-formatted logical subsystems (4096 CKD logical devices) and up to 16 fixed-block logical subsystems (4096 fixed-block logical devices). The logical subsystem facilitates configuration of DS8000 series and might have other implications relative to the operation of certain functions. There is a one-to-one mapping between a CKD logical subsystem and IBM Z control-unit image. For IBM Z hosts, a logical subsystem represents a Logical Control Unit (LCU). Each control-unit image is associated with only one logical subsystem. See also *control-unit image*.

Logical unit:

In open systems, a logical disk drive.

Logical Unit Number (LUN):

In the SCSI protocol, a unique number that is used on a SCSI bus to enable it to differentiate between separate devices, each of which is a logical unit. The logical unit number reported to the host by the storage system. The host uses the LUN to identify the volume for SCSI commands.

Logical volume:

The storage medium that is associated with a logical disk drive. A logical volume typically resides on one or more storage devices. The DS8000 administrator defines this unit of storage. The logical volume, when residing on a RAID-formatted array, is spread over the drives in the array.

Logical Volume Manager (LVM):

A set of system commands, library routines, and other tools that allow the user to establish and control logical volume storage. The LVM maps data between the logical view of storage space and the physical drive module.

Longitudinal Redundancy Check (LRC):

1)A method of error checking during data transfer that involves checking parity on a row of binary digits that are members of a set that forms a matrix. Longitudinal redundancy check is also called a longitudinal parity check.
2)A mechanism that DS8000 series uses for locating errors. The LRC checks the data as it progresses from the host, through theDS8000 controller, into the device adapter, and to the array.

Longwave cable:

Longwave laser has a wavelength of about 1300nm. Used for distances up to 10K between Fibre Channel switches and bridges.

Loop:

The physical connection between a pair of device adapters in the DS8000 storage system. See also *device adapter*.

LPAR:

See *Logical PARtition*.

LSS:

See *Logical SubSystem*.

LUN:

See *Logical Unit Number*.

LVM:

See *Logical Volume Manager*.

LXC (Linux Containers):

Is an operating-system-level virtualization method for running multiple isolated Linux systems (containers) on a control host using a single Linux kernel.

LXD:

Is a daemon, which provides a REST API to drive LXC containers. Its main goal is to provide a user experience that's similar to that of virtual machines but using Linux containers rather than hardware virtualization.

M

Machine Reported Product Data (MRPD):
Product data gathered by a machine and sent to a destination such as an IBM support server or RETAIN. These records might include such information as feature code information and product logical configuration information.

Machine code:
A set of instructions executed directly by a computer's Central Processing Unit (CPU).

MacVTap:
MacVTap is a new device driver meant to simplify virtualized bridged networking.

Mainframe:
A computer, usually in a computer center, with extensive capabilities and resources to which other computers may be connected so that they can share facilities. (T)

Management console:
See *Hardware Management Console*.

Management Information Base (MIB):
1)A collection of objects that can be accessed by means of a network management protocol.

2)The MIB record conforms to the Open Systems Interconnection (OSI) standard defined by the International Organization for Standardization (ISO) for the exchange of information. See also *simple network management protocol*.

Master storage system:
The physical unit that controls the creation of consistency groups in a Global Mirror session. The master storage system sends commands to subordinate storage systems. A storage system can be a master for only one Global Mirror session. Contrast with *subordinate storage system*.

Maximum consistency group drain time:
The value in seconds that indicates the maximum time that writes from the local site are
delayed to the remote site while the current consistency group is being formed at the remote site. When this time is exceeded, the current attempt to form a consistency group is ended and another attempt is started. If this time is exceeded five times, this maximum time is ignored on the next attempt to form a consistency group. The default value is the larger of four minutes or two times the consistency group interval time if this value is set to zero.

Maximum coordination time:
The value in milliseconds that indicates the maximum time that is allowed for host I/O to be delayed during the coordination of the primary volumes of an Global Mirror session. The default is 50 milliseconds if this value is set to zero.

MB:
See *megabyte*.

MC:
See *Hardware Management Console*.

MCM:
See *Multi-Chip Module:*

MCU:
See *Multicylinder Unit.*

Medium:
For a storage system, the disk surface on which data is stored.

Megabyte (MB):
1)For processor storage, real and virtual storage, and channel volume, 2^{20} or 1 048 576 bytes.
2)For disk storage capacity and communications volume, 1 000 000 bytes.

Memory:
Also called storage, is a technology consisting of computer components and recording media used to retain digital data. It is a core function

and fundamental component of computers.

MFT:

See *Multiprogramming with a fixed number of tasks.*

Miscellaneous Equipment Specification (MES):

Any server hardware change (addition, improvement, removal, or any combination of these). The server's serial number does not change. Specific types include the following: Customer-Installable Feature (CIF) MES or Install-By-IBM (IBI) MES.

Metro Global Mirror:

A three-site, high availability, disaster recovery solution. Metro Global Mirror uses synchronous replication to mirror data between a local site and an intermediate site, and asynchronous replication to mirror data from an intermediate site to a remote site. A cascaded solution where Metro Mirror synchronously copies data to the target site. This Metro Mirror target is the source volume for Global Mirror that asynchronously copies data to a third site. This solution has the potential to provide a disaster recovery with no data loss at Global Mirror distances when the intermediate site does not participate in the disaster that occurs at the production site.

Metro Mirror:

A function of a storage server that maintains a consistent copy of a logical volume on the same

storage server or on another storage server. All modifications that any attached host initiates on the primary logical volume are also processed on the secondary logical volume. See also *Remote Mirror and Copy* and *Global Copy*.

MIB:

See *Management Information Base.*

Microcode:

A technique that imposes an interpreter between the hardware and the architectural level of a computer. As such, the microcode is a layer of hardware-level instructions that implement higher-level machine code instructions or internal state machine sequencing in many digital processing elements. Microcode is used in general-purpose Central Processing Units (CPUs), as well as in more specialized processors. and in other hardware. Microcode typically resides in special high-speed memory and translates machine instructions, state machine data, or other input into sequences of detailed circuit-level operations. It separates the machine instructions from the underlying electronics so that instructions can be designed and altered more freely. It also facilitates the building of complex multi-step instructions, while reducing the complexity of computer circuits.

Microsoft Hyper-V:

Code named Viridian and formerly known as Windows Server Virtualization, is a native hypervisor; it can create virtual machines on x86-64 systems running Windows.

Migration:

The replacement of a system or subsystem with a different type of system or subsystem, such as replacing a SCSI host adapter with a Fibre Channel host adapter. In the context of data migration regarding DS8000 series, the transfer of data from one storage system to another, such as from a 3390 to DS8000 series.

MIH:

See *Missing-Interrupt Handler.*

Million Service Units (MSUs):

Is a measurement of the amount of processing

work a computer can perform in one hour. It reflects how IBM rates the machine in terms of charging capacity.

Mirrored pair:

Two units that contain the same data. The system refers to them as one entity.

Mirroring:

In host systems, the process of writing the same data to two disk units within the same auxiliary storage pool at the same time.

MLAG:

See *Multi-link Aggregation.*

MRPD:

See *Machine Reported Product Data*.

MSUs:

See *Million Service Units.*

MySQL:

Is a freely available open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL).

Multi-Chip Module (MCM:

Is an electronic assembly (such as a package with a number of conductor terminals or "pins") where multiple integrated circuits, semiconductor dies and/or other discrete components are integrated, usually onto a unifying substrate, so that in use it is treated as if it were a single component.

Multicylinder Unit (MCU):

This term refers to a fixed unit of disk space that is larger than a cylinder. Currently, on an EAV, a multicylinder unit is 21 cylinders and the number of the first cylinder in each multicylinder unit is a multiple of 21.

Multipath Subsystem Device Driver:

See *IBM DS8000 Multipath Subsystem Device Driver*.

Multi-link Aggregation (MLAG):

Enables arrangement of aggregated groups on two separate switchboards of the MLAG-domain.

Multiple allegiance:

A DS8000 hardware function that is independent of software support. This function enables multiple system images to concurrently access the same logical volume on DS8000 series as long as the system images are accessing different extents. See also *extent* and *parallel access volumes*.

Multiple relationship FlashCopy:

An option of DS8000 series that creates backup copies from one source to multiple targets by simultaneously establishing multiple FlashCopy relationships.

Multiplex:

The action of transmitting simultaneously.

Multiprocessor:

A computer that includes two or more processors that have common access to a main storage. For DS8000 series, the multiprocessors operate in parallel.

Multiprogramming with a fixed number of tasks (MFT):

Each job gets just the amount of memory it needs. That is, the partitioning of memory changes as jobs enter and leave. MVT is a more efficient user of resources.

Multiprogramming variable number of tasks (MVT):

Is a feature of large computers that allows more efficient operation by having multiple programs (tasks) present and operating in the mainframe computer simultaneously.

Multiple Virtual Systems (MVS):

Was the most commonly used operating system on the System/370 and System/390 IBM mainframe computers.

N

Name server:

A server that stores names of the participating DS8000 clusters.

NAS:

See *Network Attached Storage.*

NBD:

See *Network Block Device.*

Near-line:

A type of intermediate storage between online storage (which provides constant, rapid access to data) and off-line storage (which provides infrequent data access for backup purposes or long-term storage).

Network Attached Storage (NAS):

Is a file-level computer data storage server connected to a computer network providing data access to a heterogeneous group of clients. NAS is specialized for serving files either by its hardware, software, or configuration.

Network Block Device (NBD):

Is a device node whose content is provided by a remote machine. Typically, network block devices are used to access a storage device that does not physically reside in the local machine but on a remote one.

Network File System (NFS):

Is a client/server application that lets a computer user view and optionally store and update files on a remote computer as though they were on the user's own computer.

Network Interface Card (NIC):

A network interface controller (NIC, also known as a network interface card, network adapter, LAN adapter or physical network interface, and by similar terms) is a computer hardware component that connects a computer to a computer network.

Network manager:

A program or group of programs that is used to monitor, manage, and diagnose the problems of a network.

Network Time Protocol (NTP):

Is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. In operation since before 1985, NTP is one of the oldest Internet protocols in current use.

Node:

The unit that is connected in a Fibre Channel network. DS8000 series is a node in a Fibre Channel network.

Non-removable medium:

A recording medium that cannot be added to or removed from a storage device.

NonVolatile Storage (NVS):

Memory that stores active write data to avoid data loss in the event of a power loss.

NVS:

See *NonVolatile Storage*.

N+1 redundancy:

Is a form of resilience that ensures system availability in the event of component failure. Components (N) have at least one independent backup component (+1).

O

Octal:

Octal, from Latin octo or "eight") is a term that describes a base-8 number system. An octal number system consists of eight single-digit numbers: 0, 1, 2, 3, 4, 5, 6, and 7.

OMVS:

The first implementation was known as MVS OpenEdition (or OE, or OMVS), then it became OS/390 UNIX System Services, and finally z/OS UNIX System Services, as we know it today.

`OMVS` command:

Is used to invoke the z/OS UNIX shell. Users whose primary interactive computing environment is a UNIX system should find the z/OS UNIX shell environment familiar. The OMVS command is used to invoke the z/OS UNIX shell. The shell is a command processor that invokes shell commands or utilities that request services from the system, writes shell scripts using the shell programming language

and runs shell scripts and C-language programs interactively (in the foreground), in the background, or in batch.

OnLine Transaction Processing (OLTP):

A class of information systems that facilitate and manage transaction-oriented applications, typically for data entry and retrieval transaction processing. OLTP has also been used to refer to processing in which the system responds immediately to user requests.

OpenFlow:

Is a protocol that allows a server to tell network switches where to send packets. In a conventional network, each switch has proprietary software that tells it what to do. With OpenFlow, the packet-moving decisions are centralized, so that the network can be programmed independently of the individual switches and data center gear.

OpenStack:

Is a set of software tools for building and managing cloud computing platforms for public and private clouds. Backed by some of the biggest companies in software development and hosting, as well as thousands of individual community members, many think that OpenStack is the future of cloud computing.

Open source software:

Open source refers to a program or software in which the source code (the form of the program when a programmer writes a program in a particular programming language) is available to the general public for use and/or modification from its original design free of charge. Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community.

Open system:

A system whose characteristics comply with standards made available throughout the industry and that therefore can be connected to other systems complying with the same standards. Applied to DS8000 series, such

systems are those hosts that connect to DS8000 series through SCSI or FCP protocols. See also *small computer system interface* and *Fibre Channel Protocol*.

Open System Adapter (OSA):

Is the only LAN (Local Area Network) attachment to the IBM Systems.

Open vSwitch (OVS):

Open vSwitch is a production quality, multilayer virtual switch licensed under the open source Apache 2.0 license. It is designed to enable massive network automation through programmatic extension, while still supporting standard management interfaces and protocols.

Operating System (OS):

Is system software that manages computer hardware and software resources and provides common services for computer programs.

Open Systems I 390: (OSI390):

Is an IBM operating system for the System/390 IBM mainframe computers.

P

PaaS:

See *Platform As A Service.*

PAM:

See *Pluggable Authentication Module.*

Panel:

The formatted display of information that appears on a display screen.

Parallel Access Volume (PAV):

A licensed function of DS8000 series that enables z/OS systems to issue concurrent I/O requests against a count key data logical volume by associating multiple devices of a single control-unit image with a single logical device. Up to eight device addresses can be assigned to a PAV. The PAV function enables two or more concurrent write operations to the same logical volume, as long as the write operations are not to the same extents.

Parallel Sysplex License Charge (PSLC):

Charges for Parallel Sysplex licenses.

Parity:

A data checking scheme used in a computer system to ensure the integrity of the data. The RAID implementation uses parity to re-create data if a disk drive fails.

Partitioned Data Set (PDS):

Is a data set containing multiple members, each of which holds a separate sub-data set, similar to a directory in other types of file systems.

Partitioned Data Set Extended (PDSE):

Is a data set type that is managed by DFSMS. Externally, a PDSE is very similar to a PDS. Internally, the PDSE has a different directory structure, member format, and record format. A PDSE is indistinguishable from a PDS through most interfaces used to access a PDS directory or member. All ISPF functions support the PDSE.

Path group:

In IBM Z architecture, a set of channel paths that are defined to a control unit as being associated with a single Logical PARtition (LPAR). The channel paths are in a group state and are online to the host. See also *logical partition*.

PAV:

See *Parallel Access Volumes*.

PCHID:

See *Physical Channel Path Identifier.*

PCI:

See *Peripheral Component Interconnect*.

PCIe:

See *Peripheral Component Interconnect Express.*

PDF:

See *Program Development Facility.*

PDS:

See *Partitioned Data Set.*

PDSE:

See *Partitioned Data Set Extended.*

PDU:

See *Protocol Data Unit*.

PDU:

See *Power Distribution Unit.*

Peripheral Component Interconnect (PCI): An architecture for a system bus and associated protocols that supports

attachments
of adapter cards to a system backplane.

Peripheral Component Interconnect Express (PCIe or PCIe):

Is a serial expansion bus standard for connecting a computer to one or more peripheral devices. PCIe provides lower latency and higher data transfer rates than parallel busses such as PCI and PCI-X. Every device that's connected to a motherboard with a PCIe link has its own dedicated point-to-point connection. This means that devices are not competing for bandwidth because they are not sharing the same bus.

Peer-to-Peer Remote Copy (PPRC):

Is a protocol to replicate a storage volume to another control unit in a remote site. Synchronous PPRC causes each write to the primary volume to be performed to the secondary as well, and the I/O is only considered complete when update to both primary and secondary have completed. Asynchronous PPRC will flag tracks on the primary to be duplicated to the secondary when time permits.

Performance Groups:

Are used to assign a numerical value to a performance policy.

Peripheral:

Is defined as any auxiliary device such as a tape drive, disk drive, mouse, or keyboard that connects to and works with the computer in some way.

Persistent FlashCopy:

A state where a FlashCopy relationship remains indefinitely until the user deletes it. The

relationship between the source and target volumes is maintained after a background copy completes.

PFI:

See *Predictive Failure Analysis.*

Physical Channel Path Identifier (PCHID):

Specifies a physical channel identifier related to their physical location.

Physical path:

A single path through the I/O interconnection fabric that attaches two units. For Copy Services, this is the path from a host adapter on one DS8000 storage system (through cabling and switches) to a host adapter on another DS8000 storage system.

Pinned data:

Data that is held in cache until either an error condition is corrected and it can be moved to disk storage or until the data is discarded by a host command. Pinned data conditions can only occur on an ESS Model 800 during fast-write or dual-copy functions.

PKI:

See *Public Key Infrastructure.*

Platform As A Service (PaaS):

Platform as a service (PaaS) or application platform as a service (aPaaS) is a category of cloud computing services that provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app. PaaS can be delivered in two ways: As a public cloud service from a provider, where the consumer controls software deployment with minimal configuration options, and the provider provides the networks, servers, storage, operating system, middleware, database, and other services to host the consumer's application; or as a private service (software or appliance) inside the firewall, or as software deployed on a public infrastructure as a service.

Pluggable Authentication Module (PAM):
A mechanism to integrate multiple low-level authentication schemes into a high-level API. It allows programs that rely on authentication to be written independently of the underlying authentication scheme.

Point-to-point connection:
A Fibre Channel topology that enables the direct interconnection of ports. See also *arbitrated loop* and *switched fabric*.

Port:
A physical connection on a host adapter to the cable that connects the DS8000 storage system to hosts, switches, or another DS8000 storage system. DS8000 series uses SCSI and ESCON host adapters that have two ports per adapter, and Fibre Channel host adapters that have one port. See also *ESCON*, *Fibre Channel*, *host adapter*, and *small computer system interface*.

Portable Operating System Interface (POSIX):
POSIX is a set of standard operating system interfaces based on the UNIX operating system.

Positional operands (In UNIX):
Positional operands follow the command name in a certain order. In the command descriptions within this topic, the positional operands are shown in lowercase characters. When you enter a positional operand that is a list of several names or values, you must enclose the list within parentheses.

PostgreSQL:
Often simply Postgres, is an object-relational database management system (ORDBMS) with an emphasis on extensibility and standards compliance. As a database server, its primary functions are to store data securely and return that data in response to requests from other software applications. It can handle workloads ranging from small single-machine applications to large Internet-facing applications (or for data warehousing) with many concurrent users; on macOS Server, PostgreSQL is the default database; and it is also available for Microsoft Windows and Linux.

Power Distribution Unit (PDU):
A type of electrical component that distributes and manages electricity supply to computers, servers, and networking devices within a data center environment. It provides a central unit to control and distribute electricity across the data center components. Power distribution units are also known as Main Distribution Units (MDUs).

Power Supply Unit (PSU):
Converts mains AC to low-voltage regulated DC power for the internal components of a computer.

PPS:
See *Primary Power Supply.*

Predictive Failure Analysis (PFA):
Can anticipate certain forms of failures by keeping internal statistics of read and write errors. If the error rates exceed predetermined threshold values, the drive is nominated for replacement. Because the drive has not yet failed, data can be copied directly to a spare drive. This copy ability avoids the use of RAID recovery to reconstruct all of the data onto the spare drive.

Preventive Service Planning (PSP):
Is formation, which contains the latest information that is applicable to machine's hardware and software. PSP information should be reviewed before all system installs, hardware, and software updates. PSP information is provided by the IBM software support center to use when installing a

licensed program, cumulative PTF packages, or hardware. It can also be used to order preventive service planning information and review the recommended High Impact PERvasive (HIPER) fixes periodically or to order the HIPER PTF group. The HIPER PTF group is updated every other week.

Primary control program (PCP):

The program which provides the sequential scheduling of jobs and basic operating systems functions.

Primary control unit:

The DS8000 storage system to which a Remote Mirror and Copy primary device is physically attached.

Primary Power Supply (PPS):

A wide range power supply that converts AC input voltage into DC voltage.

`PRINTDS` command (In UNIX):

Use the `PRINTDS` command to format and print data sets on any printer defined to the Job Entry Subsystem (JES).

Processor:

The key component of a computing device that contains the circuitry necessary to interpret and execute electrical signals fed into the device. Its basic job is to receive input and provide the appropriate output. Also referred to as CPU or core.

Processor complex:

The set of hardware that defines a mainframe, which includes the central processing units, memory, channels, controllers, and power supplies included in the box. Also known as 'Central Electronics Complex (CEC)'.

Processor node:

A partition of a storage server that is capable of performing all defined functions of the storage server. Multiple processor complexes provide redundancy.

Processor Resource System Manager (PRISM):

Is a type-1 Hypervisor (a virtual machine monitor) that allows multiple logical partitions to share physical resources such as CPUs, I/O channels and direct access storage devices (DASD). It is integrated with all IBM Z mainframes.

Processor Unit (PU):

All of the processors in the CPC begin as equivalent processor units (PUs) or engines

that have not been characterized for use. Each processor is characterized by IBM during installation or at a later time.

The potential characterizations are:

- Central Processor (CP)
- System Assistance Processor (SAP)
- Integrated Facility for Linux (IFL)
- z Application Assist Processor (zAAP)
- The System z9 Integrated Information Processor (zIIP)
- Integrated Coupling Facility (ICF)
- Spare: An uncharacterized PU functions as a spare. If the system controllers detect a failing CP or SAP, it can be replaced with a spare PU. In most cases this can be done without any system interruption, even for the application running on the failing processor.

`PROFILE` command (In UNIX):

The `PROFILE` command establishes, changes, or lists your user profile. The information in your profile tells the system how you want to use your terminal.

Program:

On a computer, a generic term for software that controls the operation of the computer. Typically, the program is a logical assemblage of software modules that perform multiple related tasks.

Program Development Facility (PDF):

Provides a panel-driven menu interface and a number of services through which users can work with source code and data stored on a host.

Program Temporary Fix (PTF):

A temporary solution to, or bypass of, a problem diagnosed by IBM as the result of a defect in a current unaltered release of a licensed program.

Promote:

To add a logical data unit to cache memory.

Protocol Data Unit (PDU):

A unit of data specified in the protocol of a given layer and consisting of protocol control information for the layer and, possibly, user data for the layer.

PRISM:

See *Processor Resource System Manager.*

Pseudo host:

A host connection that is not explicitly defined to the DS8000 storage system and that has access to at least one volume that is configured on the DS8000 storage system. The FiconNet pseudo host icon represents the FICON protocol. The EsconNet pseudo host icon represents the ESCON protocol. The pseudo host icon labeled Anonymous represents hosts connected through the FCP protocol.
Anonymous host is a commonly used synonym for *pseudo host*. DS8000 series adds a pseudo host icon only when it is set to access-any mode. See also *access-any mode*.

PSP:

See *Preventive Service Planning.*

PSU:

See *Power Supply Unit.*

PTF:

See *Program Temporary Fix*.

Public Key Infrastructure (PKI):

Supports the distribution and identification of public encryption keys, enabling users and computers to both securely exchange data over networks such as the Internet and verify the identity of the other party.

PV Links:

Short for Physical Volume Links, an alternate pathing solution from Hewlett-Packard that provides for multiple paths to a volume, as well as static load balancing.

Q

qcow2 (QEMU Copy On Write):

Is a file format for disk image files used by QEMU, a hosted virtual machine monitor. It uses a disk storage optimization strategy that delays allocation of storage until it is actually needed. Files in qcow format can contain a variety of disk images, which are generally associated with specific guest operating systems.

QEMU:

QEMU (short for Quick Emulator) is a free and open-source hosted hypervisor that performs hardware virtualization (not to be confused with hardware-assisted virtualization). QEMU is a hosted virtual machine monitor: it emulates CPUs through dynamic binary translation and provides a set of device models, enabling it to run a variety of unmodified guest operating systems. It also can be used together with KVM in order to run virtual machines at near-native speed (requiring hardware virtualization extensions on x86 machines). QEMU can also do CPU emulation for user-level processes, allowing applications compiled for one architecture to run on another.

Quality of Service (QoS):

An assessment of how well a delivered service

conforms to the client's expectations. Service business operators often assess the service quality provided to their customers in order to improve their service, to quickly identify problems, and to better assess client satisfaction.

R

RACF:

See *Resource Access Control Facility.*

Rack Power Control (RPC) cards:

Manages the DS8000 power subsystem and provide control, monitoring, and reporting
functions. RPC cards are responsible for receiving DC-UPS status and controlling DC-UPS functions.

Rack Unit:

Abbreviated as U or RU, is a unit of measure defined as 1.75 inches (44.45mm). It is most frequently used as a measurement of the overall height of 19-inch and 23-inch rack frames, as well as the height of equipment that mounts in these frames, whereby the height of

the frame or equipment is expressed as multiples of rack units.

RAID:

See *redundant array of independent disks*. RAID is also commonly expanded to redundant array of *inexpensive* disks. See also *array*.

RAID 5:

A type of RAID that optimizes cost-effective performance while emphasizing use of available capacity through data striping. RAID 5 provides fault tolerance for up to two failed disk drives by distributing parity across all the drives in the array plus one parity disk drive. DS8000 series automatically reserves spare disk drives when it assigns arrays to a Device Adapter pair (DA pair). See also *device adapter*, *RAID 10*, and *redundant array of independent disks*.

RAID 6:

Any form of RAID that can continue to process read and write requests to all virtual disks of an array in the presence of two concurrent failures. See also *device adapter*, *RAID 5*, *RAID 10*, and *redundant array of independent disks*.

RAID 10:

A type of RAID that optimizes high performance while maintaining fault tolerance for up to two failed disk drives by striping volume data across several disk drives and mirroring the first set of disk drives on an identical set. DS8000 series automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 5*, and *redundant array of independent disks*.

Random access:

A mode of accessing data on a medium in a manner that requires the storage device to access nonconsecutive storage locations on the medium.

Random Access Memory (RAM):

A type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. RAM is the most common

type of memory found in computers and other devices, such as printers.

Rank:

One or more arrays that are combined to create a logically contiguous storage space.

RAS:

See *Reliability, Availability, and Serviceability.*

Reboot:

Booting is starting a computer's operating system, so rebooting is to start it for a second or

third time. Rebooting is usually necessary after a computer crashes, meaning it stops working because of a malfunction. Rebooting allows the computer to restart and get back to working normally. After a crash, the computer is useless until it is rebooted.

Recovery Point Objective (RPO):

The maximum targeted period in which data might be lost from an IT service due to a major incident.

Recovery Time Objective (RTO):

The targeted duration of time and a service level within which a business process must be restored after a disaster (or disruption) in order to avoid unacceptable consequences associated with a break in business continuity.

`RECEIVE` command (In UNIX):

The `RECEIVE` command is used by the addressee of a file transmission to retrieve transmitted files and to restore them to their original format.

Reduced Instruction Set Computer (RISC):

Is one whose instruction set architecture (ISA) allows it to have fewer cycles per instruction (CPI) than a complex instruction set computer.

Redundant Array of Independent Disks (RAID):

A methodology of grouping disk drives for managing disk storage to insulate data from a failing disk drive.

Redundant Array of Independent Memory (RAIM):

Is a design feature found in certain computers' main random access memory. RAIM utilizes additional memory modules and striping algorithms to protect against the failure of any particular module and keep the memory system operating continuously.

Relative Record Data Set (RRDS):

Has fixed-length slots, predefined to VSAM, in which records can be stored. An RRDS record is always fixed length, equal to the slot size. A record that is in an RRDS is identified by the Relative Record Number (RRN) of the slot that holds it. When a new record is added to an RRDS, VSAM uses the number that you supply with the file control request.

Reliability, Availability, and Serviceability (RAS):

Is a computer hardware engineering term involving reliability engineering, high availability, and serviceability design. Computers designed with higher levels of RAS have many features that protect data integrity and help them stay available for long periods of time without failure, this data integrity and uptime is a particular selling point for mainframes and fault-tolerant systems.

Remote IIO loop (RIO loop):

I/O subsystems are connected to the processor subsystem through Remote I/O cable loops.
The cable loops are connected to ports that are available from the rear of the processor subsystem. The RIO cables are connected in loops so that the system has two paths to each I/O subsystem.There are two typical RIO loops: 1) one port of a hub connected to the input port of an I/O drawer, and the output port of this I/O drawer connected to the companion port of the same hub; 2) one port of a hub connected to the input port of an I/O drawer, the output port of this I/O drawer connected to the input port of another I/O drawer, and the output port of the other I/O drawer connected to the companion port of the same hub.

Remote Mirror and Copy:

A feature of a storage server that constantly updates a secondary copy of a logical volume to match changes made to a primary logical volume. The primary and secondary volumes

can be on the same storage server or on separate storage servers. See also *Global Mirror*, *Metro Mirror, and Global Copy*.

Remote Procedure Call (RPC):

In distributed computing, a remote procedure call (RPC) is when a computer program causes a procedure (subroutine) to execute in a different address space (commonly on another computer on a shared network), which is coded as if it were a normal (local) procedure call, without the programmer explicitly coding the details for the remote interaction.

Reporting task commands:

Used for creating reports.

Resource Access Control Facility (RACF):

A security system that provides access control and auditing functionality for the z/OS and z/VM
operating systems.

Resource Management Facility (RMF):

IBM's strategic product for z/OS performance measurement and management. It is the base product to collect performance data for z/OS and sysplex environments to monitor systems' performance behavior and provides the ability to optimally tune and configure the system according to business needs.

REST API:

A REST API defines a set of functions which developers can perform requests and receive responses using HTTP protocol such as GET and POST. Because REST API's use HTTP, they can be used by practically any programming language and easy to test (it's a requirement of a REST API that the client and server are independent of each other allowing either to be coded in any language and improved upon supporting longevity and evolution).

Resource Group:

Define a collection of resources and associate a set of policies relative to how the resources are configured and managed.

RESTful API:

Is an application programming interface (API) that uses HTTP requests to GET, PUT, POST, and DELETE data.

Restructured Extended Executor (REXX):

REXX is an interpreted programming language developed at IBM. It is a structured, high-level programming language designed for ease of learning and reading. Proprietary and open source REXX interpreters exist for a wide range of computing platforms; compilers exist for IBM mainframe computers.

Revolutions Per Minute (RPM):

Used to help determine the access time on computer hard drives. RPM is a measurement of how many revolutions a computer's hard drive makes in a single minute. The higher the RPM, the faster the data will be accessed.

RIO loop:

See *Remote I/O loop.*

RISC:

See *Reduced Instruction Set Computer.*

R0:

See *track-descriptor record*.

Rotate extents:

Distributes the extents of each volume successfully across all ranks in a pool to achieve a well balanced capacity based distribution of the workload. See *Storage Pool Striping.*

Rotate volume:

Reduces the configuration effort compared to single rank extent pools by easily distributing a set of volumes to different ranks in a specific extent pool for workloads where the use of host based stripping methods is still present.

RPC:

See *Rack Power Control cards or Remote Procedure Call.*

RPM:

See *Revolutions Per Minute.*

RRDS:

See *Relative Record Data Set.*

RSA:

Is algorithm used by modern computers to encrypt and decrypt messages. It is an asymmetric cryptographic algorithm. Asymmetric means that there are two different keys. This is also called public key cryptography, because one of them can be given to everyone. The other key must be kept private. It is based on the fact that finding the factors of an integer is hard (the factoring problem). RSA stands for Ron Rivest, Adi Shamir, and Leonard Adleman, who first publicly described it in 1978.

S

SAF:

See *System Access Facility.*

SAID:

See *System Adapter Identification Number*.

SAM:

See *Sequential Access Method*.

SAN:

See *Storage Area Network*.

SAP:

See *System Assistance Processor.*

SARC:

See *Sequential Adaptive Replacement Cache.*

SAS:

See *Statistical Analysis System***.**

SE:

See *Support Element.*

Screen:

The physical surface of a display device upon which information is shown to users.

Script command mode:

The main thing to remember here is that the script that DS CLI executes can only contain DS CLI commands.

SCSI:

See *Small Computer System Interface*.

SCSI device:

A disk drive connected to a host through an I/O interface using the SCSI protocol. A SCSI device is either an initiator or a target. See also *initiator* and *small computer system interface*.

SCSI-FCP:

Synonym for Fibre Channel Protocol, a protocol used to transport data between an open-systems host and a Fibre Channel adapter on a DS8000. See also *Fibre Channel Protocol* and *small computer system interface*.

SDD:

See *IBM Subsystem Multipathing Device Driver*.

SE:

See *Support Element.*

Secondary control unit:

The DS8000 to which a Remote Mirror and Copy secondary device is physically attached.

Secure Data Overwrite (SDO):

A method of securely overwriting sensitive data in a way that makes the data unreadable.

Secure Hash Algorithm 3 (SHA-3):

A cryptographic hash algorithm (alternatively, hash "function") is designed to

provide a random mapping from a string of binary data to a fixed-size "message digest" and achieve certain security properties. Hash algorithms can be used for digital signatures, message authentication codes, key derivation functions, pseudo random functions, and many other security applications

Sector:

An area of a disk that contains the smallest addressable unit of information. When a disk is formatted, the operating system divides it into sectors and tracks. A sector is the theoretically minimal region of the disk upon which data can be read or written at one time.

`SEND` command (In UNIX):

Use the `SEND` command to send messages to other users. To receive the messages, the recipient's profile setting must include INTERCOM.

Sequential access:

A mode of accessing data on a medium in a manner that requires the storage device to access consecutive storage locations on the medium.

Sequential Adaptive Replacement Cache (SARC):

Is a caching algorithm that allows you to run different workloads, such as sequential and random workloads, without negatively affecting each other.

Sequential Data Set:

In a sequential data set, records are data items that are stored consecutively.

Serial Attached SCSI (SAS):

Full-duplex. Uses the native SCSI command set, which has more functionality. A SAS drive uses SCSI error checking and reporting. This allows your storage system to collect richer information from the drive if errors are occurring (such as a failing or marginal disk). SAS drives are dual ported, which is vital in dual controller enclosures.

Serial connection:

A method of device interconnection for determining interrupt priority by connecting the interrupt sources serially.

Server:

A host that provides certain services to other hosts that are referred to as clients.
A functional unit that provides services to one or more clients over a network.

Server Time Protocol (STP):

Is a server-wide facility that is implemented in the Licensed Internal Code (LIC) and presents a single view of time to Processor Resource/Systems Manager (PR/SM).

Service clearance:

The area that is required to open the service covers and to pull out components for servicing.

Service Information Message (SIM):

A message sent by a storage server to service personnel through an IBM Z operating system.

Service personnel:

A generalization referring to individuals or companies authorized to service the DS8880. The terms *service provider*, *service representative*, and *IBM service representative* refer to types of service personnel. See also *System Services Representative.*

Service provider interface (SPI):

The set of public interfaces and abstract classes that a service defines. The SPI defines the classes and methods available to your application.

SES:

SCSI Enclosure Services.

Session:

A collection of volumes within a logical subsystem that are managed together during the creation of consistent copies of data. All volumes in a session must transfer their data successfully to the remote site before the increment can be called complete.

SFF:

See *Small Form Factor.*

SFI:

See *Storage Facility Image.*

SHA-3:

See *Secure Hash Algorithm 3.*

Shared storage:

Storage that is configured so that multiple hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must have a common model for the information on a storage device. The programs must be

designed to handle the effects of concurrent access.

Shortwave cable:

Shortwave laser uses a wavelength of approximately 850 nm. Typically used for medium and longer distance connections (up to 500m).

SIM:

See *Service Information Message*.

Simple Network Management Protocol (SNMP):

In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB). See also *management information base*.

Simultaneous Multithreading (SMT):

Is a technique for improving the overall efficiency of superscalar CPUs with hardware multithreading. SMT permits multiple independent threads of execution to better utilize the resources provided by modern processor architectures.

Single-Byte Command Code Sets Connection (SBCON):

The ANSI standard for the ESCON I/O interface.

Single Point Of Failure (SPOF):

A potential risk posed by a flaw in the design, implementation, or configuration of a circuit or system in which one fault or malfunction causes an entire system to stop operating.

Single-shot mode:

Use the DS CLI single-shot command mode if your want to issue an occasional command but do not want to keep a history of the commands that you have issued. When typing the command, you can use the host name or the IP address of the DS HMC. Wait for the command to process and display the end results.

Single Virtual Storage (SVS):

An operating system from IBM. OS/VS2 R1 was known as SVS (Single Virtual Storage) as it had a single 16 MB virtual address space.
Takes advantage of virtual memory.

Small Computer System Interface (SCSI): A standard hardware interface that enables a variety of peripheral devices to communicate
with one another.

Smart relay host:

A mail relay or mail gateway that has the capability to correct email addressing problems.

Small Form Factor (SFF):

2.5-inch hard disk drives (HDDs). The measurement represent the approximate diameter of the platter within the drive enclosures.

SMF:

See *System Management Facility.*

SMP:

See *Symmetrical MultiProcessor*.

SMT:

See *Simultaneous Multithreading.*

SNMP:

See *Simple Network Management Protocol*.

SNMP agent:

A server process that resides on a network node and is responsible for communicating with managers regarding that node. The node is represented as a managed object, which has various fields or variables that are defined in the appropriate MIB.

SNMP manager:

A managing system that runs a managing application or suite of applications. These applications depend on Management Information Base (MIB) objects for information that resides on the managed system. Managers generate requests for this MIB information, and an SNMP agent on the managed system responds to these requests. A request can either be the retrieval or modification of MIB information.

Software:

Is the part of a computer system that consists of encoded information or computer instructions.

Solid State Drive (SSD):

Are high-IOPS (Input/Output Operations Per Second) class enterprise storage devices targeted at business critical production applications that can benefit from high level of fast-access storage.

Source device:

One of the devices in a dual-copy or remote-copy volume pair. All
channel
commands to the logical volume are directed to the source device. The data on the source device is duplicated on the target device. See also *target device.*

Space efficient volumes:

A space efficient volume does not occupy physical capacity when it is created. Space gets allocated when data is actually written to the volume. The amount of space that gets physically allocated is a function of the amount of data changes that are performed on a volume. The sum of all defined space efficient volumes can be larger than the physical capacity available.

Spare:

A disk drive on the DS8000 that can replace a failed disk drive. A spare can be predesignated to allow automatic dynamic sparing. Any data preexisting on a disk drive that is invoked as a spare is destroyed by the dynamic sparing copy process.

SPI:

See *Service provider interface.*

SPOF:

See *Single Point Of Failure.*

SRM:

See *Storage Resource Management.*

SSD:

See *Solid State Drive*.

SSID:

See *SubSystem IDentifier*.

SSPC:

See *System Storage Productivity Center.*

SSR:

See *System Services Representative.*

Staging:

To move data from an offline or low-priority device back to an online or higher priority device, usually on demand of the system or on request of the user.

Standard volume:

A volume that emulates one of several IBM Z volume types, including 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode), by presenting the same number of cylinders and capacity to the host as provided by the native IBM Z volume type of the same name.

Statistical Analysis System (SAS):

Is a software suite developed by SAS Institute for advanced analytics, multivariate analyses, business intelligence, data management, and predictive analytics.

Storage:

Also called memory, is a technology consisting of computer components and recording media used to retain digital data. It is a core function and fundamental component of computers.

Storage Area Network (SAN):

A network that connects a company's heterogeneous storage resources.

Storage capacity:

The amount of data that a storage medium can hold; usually expressed in kilobytes, megabytes, or gigabytes.

Storage complex:

A configuration of one or more storage systems that is managed by a management console.

Storage device:

A physical unit that provides a mechanism to store data on a given medium such that it can be subsequently retrieved.

Storage Facility Image (SFI):

A storage facility image consists of two LPARs, one on each processor complex in a storage facility. A storage facility image is capable of performing all functions of a storage server from the host's perspective. More than one SFI can be configured on a storage facility. A storage facility image might also be referred to as a storage image.

Storage image:

A partitioning of a storage system that provides emulation of a storage server with one or more storage devices that provides storage capability to a host computer. You can configure more than one storage image on a storage system. (DS8000 series only)

Storage pool striping:

Improves overall performance and reduces the effort of performance management by evenly distributing data and workloads across a larger set of ranks, which reduces skew and hot spots. See *Rotate Extents.*

Storage Resource Management (SRM):

Is a proactive approach to optimizing the efficiency and speed with which available drive space is utilized in a Storage Area Network (SAN).

Storage server:

A physical unit that manages attached storage devices and provides an interface between them and a host computer by providing the function of one or more logical subsystems. The storage server can provide functions that the storage device does not provide. The storage server has one or more clusters. A storage server may also be called a file server.

Storage system:

A storage system can include facilities for host attachment, user role authentication, a Command-Line Interface (CLI), a graphical user interface (GUI), and storage devices that most often include Redundant Array of

Independent Disks (RAID) controllers. It might also include agents for enabling third-party

management software to monitor or manage the storage devices.

Storage unit:
DS8880 base frame plus installed expansion frames.

STP:

See *Server Time Protocol.*

Striping:
A data mapping technique for disk arrays in which fixed-length sequences of virtual-disk data addresses are mapped to sequences of member disk addresses in a regular rotating pattern.

`SUBMIT` command (In UNIX):
Use the `SUBMIT` command to submit one or more batch jobs for background processing.

Subordinate storage system:
The physical unit that receives commands from the master storage system and is specified when a Global Mirror session is started. The subordinate storage system forms consistency groups and performs other Global Mirror processing. A subordinate storage system can be controlled by only one master storage system. Contrast with *master storage system*.

SubSystem IDentifier (SSID):
A number that uniquely identifies a logical subsystem within a computer installation.

SuperPAV (Parallel Access Volume):
SuperPAV extends upon the previous HyperPAV capabilities by enabling alias devices
to be used across multiple Logical SubSystems (LSS). An alias device can be used for any base device on the same DS8000 server and in the same path group on the server. SuperPAV will enable performance to be sustained with fewer overall alias devices and offer greater parallelism for individual larger volumes, improving scalability and performance.

Super Zap (SZAP):
SPZAP can list, map, and modify load modules (executable programs) or patch or fix the Volume Table Of Contents (VTOC).

Support Element (SE):

A Support Element is a dedicated workstation used for monitoring and operating a system. It is attached to the central processor complex (CPC) of a system. The Support Element is located inside the same frame that the central processor complex (CPC) is located. An alternate support element is also provided to switch from your primary support element to the alternate Support Element if hardware problems occur.

Switched fabric:
A Fibre Channel topology in which ports are interconnected through a switch. Fabric switches can also be interconnected to support numerous ports on a single network. See also *arbitrated loop* and *point-to-point connection*.

System Access Facility (SAF):
Is an interface defined by z/OS that enables programs to use system authorization services to control access to resources, such as data sets and z/OS commands.

System Assistance Processor (SAP):

Every modern mainframe has at least one SAP; larger systems may have several. The SAPs execute internal code to provide the I/O subsystem. An SAP, for example, translates device numbers and real addresses of channel path identifiers (CHPIDs), control unit addresses, and device numbers. It manages multiple paths to control units and performs

error recovery for temporary errors. Operating systems and applications cannot detect SAPs, and SAPs do not use any normal memory. SAPs execute commands.

System Management Facility (SMF):

Is a component of IBM's z/OS for mainframe computers, providing a standardized method for writing out records of activity to a file.

Symmetric encryption:

Means that the encryption and decryption operations utilize the same key. For two communicating parties using symmetric encryption for secure communication, the key

represents a shared secret between the two. Symmetric encryption is typically more efficient than asymmetric encryption, and is often used for bulk data encryption.

Symmetric MultiProcessing (SMP):

Is the processing of programs by multiple processors that share a common operating system and memory. In symmetric (or 'tightly coupled') multiprocessing, the processors share memory, and the I/O bus or data path. A single copy of the operating system is in charge of all the processors.

Synchronous write:

A write operation whose completion is indicated after the data has been stored on a storage device.

System Adapter Identification Number (SAID):

The unique identification number that is automatically assigned to each DS8000 host adapter for use by Copy Services.

System Data Mover (SDM):

A DFSMS component that interacts with data storage subsystems and with various advanced copy services functions to efficiently move large amounts of data. As updates occur to primary volumes, the SDM manages the process of copying those updates to secondary volumes. The SDM ensures that updates to secondary volumes are made in the same order in which they were made to the primary volumes, maintaining sequence consistency.

System Management Facilities (SMF):

A component of IBM's z/OS for mainframe computers, providing a standardized method for writing out records of activity to a file or data set.

System Modification Program:

A program used to install software and software changes on z/OS systems.

System p:

The IBM family of products, which emphasizes performance and includes System p5, eServer

p5, eServer pSeries, eServer OpenPower, and RS/6000.

System Services Representative (SSR):
Responsible for performing basic technical services for IBM customers including some or all of the following: element exchange, minor repair, depot or bench maintenance, equipment refurbish, installation, relocation, discontinuance, upgrade and modification, and so on. Services are typically performed in a high volume environment with access to exchangeable units and parts requiring minimum, if any, problem determination activity. Services may be directed by a service call management process or be performed as part of a team.

System Storage Productivity Center (SSPC): IBM System Storage Productivity Center is an integrated offering that provides a consolidated focal point for managing IBM storage products as well as managing mixed-vendor storage environments. SSPC provides enhancements to daily storage

administration by making available a broad set of configuration functions.
System Storage Productivity Center's user-friendly interface provides utilities to
configure storage devices, and enhancements that offer a wide range of management capabilities.

System x:

The IBM family of products, which emphasizes industry-standard server scalability and
self-managing server technologies. It includes System x3nnn, eServer xSeries, and AMD processor-based eServer servers.

Systems Network Architecture (SNA):

SNA is IBM's proprietary networking architecture. It is a complete protocol stack for interconnecting computers and their resources.

T

Target:

A SCSI device that acts as a subordinate to an initiator and consists of a set of one or more logical units, each with an assigned Logical Unit Number (LUN). The logical units on the target

are typically I/O devices. A SCSI target is analogous to an IBM Z control unit. See also *small computer system interface*.

Target device:

One of the devices in a dual-copy or remote-copy volume pair that contains a duplicate of the data that is on the source device. Unlike the source device, the target device might only accept a limited subset of data. See also *source device.*

TB:

See *terabyte*.

TCO:

See *Total Cost of Ownership.*

TCP/IP:

See *Transmission Control Protocol/Internet Protocol*.

Telemetry:

OpenStack Telemetry provides user-level usage data for OpenStack-based clouds. The data can be used for customer billing, system monitoring, or alerts. Telemetry can collect data from notifications sent by existing OpenStack components such as Compute usage events, or by polling OpenStack infrastructure resources such as libvirt. Telemetry includes a storage daemon that communicates with authenticated agents through a trusted messaging system to collect and aggregate data. Additionally, the service uses a plug-in system that you can use to add new monitors. You can deploy the API Server, central agent, data store service, and collector agent on different hosts.

Terabyte (TB):

1)Nominally, 1 000 000 000 000 bytes, which is accurate when speaking of bandwidth and disk storage capacity.
2)For DS8000 cache memory, processor storage, real and virtual storage, a terabyte refers to 2^{40} or 1 099 511 627 776 bytes.

Total Cost of Ownership (TCO):

Is a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system.

Tracks:

Are concentric circles around the disk. The operating system and disk drive keep track of where information is stored on the disk by noting the range of track and sector numbers.

Transport Control Word (TCW):

A TCW combines the functions of the Prefix CCW and the Read or Write CCW into a single entity that further reduces channel overhead. Used by z High Performance FICON (zHPF)

channel programs.

Time Sharing Option (TSO):

An operating system option that provides interactive time sharing from remote terminals.

Thin provisioning:

A mechanism that provides the ability to define logical volume sizes that are larger than the physical capacity installed on the system. The volume allocates capacity on an as-needed basis as a result of host-write actions.

Tivoli Key Lifecycle Manager (TKLM):

JAVA software program that manages keys enterprise wide and provides encryption enable tape drives with keys for encryption and decryption.

Tivoli Productivity Center for Replication (TPC-R):

Provides support for Metro Mirror and Global Mirror configurations as well as three-site recovery management, supporting IBM System Storage DS8000 Metro Global Mirror and Metro Global Mirror with HyperSwap. It is designed to support fast failover and failback, fast reestablishment of three-site mirroring, data currency at the remote site with minimal lag behind the local site, and quick re-synchronization of mirrored sites using incremental changes only.

TKLM:

See *Tivoli Key Lifecycle Manager.*

Tivoli Storage Productivity Center (TPC):

The name of the suite of products comprising the Tivoli Storage Productivity Center.

TPF:

See *Transaction Processing Facility*.

Track:

A unit of storage on a CKD device that can be formatted to contain a number of data records. See also *home address*, *track-descriptor record*, and *data record*.

Track address:

This term refers to a 32-bit number that identifies each track within a volume. It is in the format hexadecimal CCCCcccH, where CCCC is the low order 16 bits of the cylinder number, ccc is the high order 12 bits of the cylinder number, and H is the four-bit track number. For compatibility with older programs, the ccc portion is hexadecimal 000 for tracks in the base addressing space.

Track managed space:

This term refers to the space on a volume that is managed in tracks and cylinders. Track-managed space ends at cylinder address 65519. Each data set occupies an integral multiple of tracks. Track-managed space also exists on all non-EAVs.

Track Space Efficient (TSE) volumes:

Are used as target volumes of a FlashCopy Space Efficient operation and require the definition of a repository from which tracks are gradually allocated.

Transaction Processing Facility (TPF): A high-availability, high-performance IBM operating system, designed to support real-time, transaction-driven applications. The specialized architecture of TPF is intended to optimize system efficiency, reliability, and responsiveness for data communication and database processing. TPF provides real-time inquiry and updates to a large, centralized database, where message length is relatively short in both directions, and response time is typically less than three seconds. Formerly known as the Airline Control

Program/Transaction Processing Facility (ACP/TPF).

Transmission Control Protocol (TCP):

A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP):
1)A combination of data-transmission protocols that provide end-to-end connections between applications over interconnected networks of different types.
2)A suite of transport and application protocols that run over the Internet Protocol. See also *Internet Protocol* and *Transmission Control Protocol*.

`TRANSMIT` command (In UNIX):
Use the `TRANSMIT` command to send messages, data sets, or both, to another user. The `TRANSMIT` command converts this data into a special format so that it can be transmitted to other users in the network.

Transparency:
See *software transparency*.

Trusted Key Entry (TKE):
A feature that is a means for ensuring secure creation and management of key material and for managing the crypto adapters on the host.

TSE:
See *Track Space Efficient.*

TSO:
See *Time Sharing Option*.

U

UFS:
UNIX Filing System.

Universal Access Authority (UAA):
Each data set profile defined using RACF requires a universal access authority (UACC). The UACC is the default access authority that RACF gives to users and groups that are not defined in the profile's access list. If one of these users or groups requests access to a data set that is protected by the profile, RACF grants or denies the request based on the UACC.

Unit address:
For IBM Z, the address associated with a device on a given control unit. On ESCON interfaces, the unit address is the same as the device address. On OEMI interfaces, the unit address specifies a control unit and device pair on the interface.

Unit Control Block (UCB):
z/OS control block used to define channel attached devices.

UNIX System Services (USS):
UNIX System Services (USS) is a required, included component of z/OS. USS is a certified UNIX operating system implementation optimized for mainframe architecture.

Upper-layer protocol:
The layer of the Internet Protocol (IP) that supports one or more logical protocols (for example, a SCSI-command protocol and an ESA/390 command protocol). Refer to ANSI X3.230-199*x*.

V

`virsh`:
Is a command line interface tool for managing guests and the hypervisor.

Virtual Ethernet Port Aggregator (VEPA):
Data from one endpoint to another endpoint on the same lower device gets sent down the lower device to external switch. If that switch supports the hairpin mode, the frames get sent

back to the lower device and from there to the destination endpoint.

Virtualization:

The act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources.

Virtual machine facility:

A virtual data processing machine that appears to the user to be for the exclusive use of that user, but whose functions are accomplished by sharing the resources of a shared data processing system. An alternate name for the VM/370 IBM operating system.

Virtual Local Access Network (VLAN):

Is any broadcast domain that is partitioned and isolated in a computer network at the data link layer. VLANs work by applying tags to network packets and handling these tags in networking systems - creating the appearance and functionality of network traffic that is physically on a single network but acts as if it is split between separate networks. In this way, VLANs can keep network applications separate despite being connected to the same physical network, and without requiring multiple sets of cabling and networking devices to be deployed.

Virtual Machine (VM):

Is an emulation of a computer system. Virtual machines are based on computer architectures and provide functionality of a physical computer.

Virtual Machine Monitor (VMM):

A Virtual Machine Monitor is a software program that enables the creation, management, and governance of virtual machines (VMs) and manages the operation of a virtualized environment on top of a physical host machine.

Virtual Memory:

Virtual memory, or virtual storage, is a feature of an operating system that allows a computer to compensate for shortages of physical memory by temporarily transferring pages of data from Random Access Memory (RAM) to disk storage.

Virtual Private Network (VPN):

is a network that is constructed using public wires, usually the Internet, to connect to a private network, such as a company's internal network.

Vital Product Data (VPD):

Information that uniquely defines the system, hardware, software, and microcode elements of a processing system.

Virtual Storage Access Method (VSAM):

VSAM is a file storage access method used in z/OS operating systems. It is a high performance access method used to organize data in form of files in Mainframes.

Virtual Telecommunications Access Method (VTAM):

VTAM is the IBM subsystem that implements Systems Network Architecture (SNA) for mainframe environments. VTAM provides an application programming interface (API) for communication applications, and controls communication equipment such as adapters and controllers.

VM:

The root name of several IBM operating systems, such as VM/XA, VM/ESA, VM/CMS, and z/VM. See also *virtual machine facility*.

VMware:

VMware provides different software and applications for virtualization. It has become

one of the key providers of virtualization software in the industry. VMware's products can be categorized in two levels: desktop applications and server applications.

VMware ESXi:

Formerly ESX, is an enterprise-class, type-1 hypervisor developed by VMware for deploying and serving virtual computers. As a type-1 hypervisor, ESXi is not a software application that one installs in an operating system; instead, it includes and integrates vital operating system components, such as a kernel.

Volume:

For IBM Z, the information recorded on a single unit of recording medium. Indirectly, it can refer to the unit of recording medium itself. On a non removable-medium storage device, the term can also indirectly refer to the storage device associated with the volume. When multiple volumes are stored on a single storage medium transparently to the program, the volumes can be referred to as logical volumes.

Volume group:

A collection of either physical or logical volumes.

Volume Table Of Contents (VTOC):

A table on a Direct Access Storage Device (DASD) volume that describes the location, size, and other characteristics of each data set on the volume.

VPD:

See *Vital Product Data*.

VSE/ESA:

An IBM operating system, the letters of which represent virtual storage extended/enterprise systems architecture.

VSAM:

See *Virtual Storage Access Method.*

VTAM:

See *Virtual Telecommunications Access Method.*

W

Warm demotion:

An operation of IBM Easy Tier automatic mode. The movement of an extent of moderately active data to a lower tier when its tier has exceeded its optimal bandwidth capacity.

Wavelength-Division Multiplexing (WDM): Is a method of combining multiple signals on laser beams at various Infrared (IR)
wavelengths for transmission along fiber optic media. Each laser is modulated by an independent set of signals.
Wavelength-sensitive filters, the IR analog of visible-light color filters, are used at the receiving end.

WebSM (Web-based System Manager):

Is a client/server application that gives the user a powerful interface to manage UNIX systems. Web-based System Manager uses its graphical interface to enable the user to access and manage multiple remote machines.

Weight distribution area:

The area that is required to distribute the weight of the storage system.

Workload Manager (WLM):

Is a base component of the z/OS mainframe operating system. It controls the access to system resources for the work executing on z/OS based on administrator-defined goals.

Worldwide Node Name (WWNN):

A unique 64-bit identifier for a host that contains a Fibre Channel port. See also *worldwide port name*.

Worldwide port name (WWPN):

A unique 64-bit identifier associated with a

Fibre Channel adapter port. It is assigned in an implementation- and protocol-independent manner. See also *worldwide node name*.

WWNN:

See *Worldwide Node Name*.

WWPN:

See *Worldwide Port Name*.

X

XCF:

See *Cross-System Coupling Facility.*

Xen:

Xen Project is a hypervisor using a micro kernel design, providing services that allow multiple computer operating systems to execute on the same computer hardware concurrently.

XES:

See *Cross-System Extended Services.*

Extensible Markup Language (XML):

Is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

Y Z

z Application Assist Processor (zAAP):

This is a processor with a number of functions disabled (interrupt handling, some instructions) such that no full operating system can be executed on the processor. However, z/OS can detect the presence of zAAP processors and will use them to execute Javacode. The same Java code can be executed on a standard CP. Again, zAAP engines are not counted when specifying the model number of the system. Like IFLs, they exist only to control software costs.Note: zAAPs are not supported on IBM z13, z13s, and the z14 mainframes.

zDAC:

See *z/OS Discovery and Auto Configuration.*

Integrated Information Processor (zIIP):

Is a specialized engine for processing eligible database workloads. The zIIP is designed to help lower software costs for select workloads on the mainframe, such as business intelligence (BI), enterprise resource planning (ERP) and customer relationship management (CRM). The zIIP reinforces the mainframe's role as the data hub of the enterprise by helping to make direct access to DB2® more cost effective and reducing the need for multiple copies of the data.

zHPF:

See *High Performance FICON for IBM Z.*

zHPF:

See *High Performance FICON for IBM Z.*

IBM Z Hypervisor Performance Manager (zHPM):

Monitors virtual machines running on KVM to achieve goal-oriented policy based performance goals.

zKVM (KVM for IBM Z):

A virtualization infrastructure for the Linux kernel that turns it into a hypervisor. It simplifies configuration and operation of server virtualization, leverages common Linux administration skills to administer virtualization, supports flexibility and agility leveraging the open source community, and provides an Open Source virtualization choice.

Zoning:

In Fibre Channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones.

zSeries File System (ZFS):

zFS is a z/OS UNIX file system that can be used like the Hierarchical File System (HFS). zFS file systems contain files and directories, including Access Control Lists (ACLs), that can be accessed with the z/OS HFS application programming interfaces (APIs).

z/OS:

An operating system for the IBM Z family of products.

z/OS Discovery and Auto Configuration (zDAC):

Designed to automatically run several I/O configuration definition tasks for new and changed disk and tape controllers that are connected to a switch or director, when attached to a FICON channel.

z/OS Global Mirror:

Remote mirror and copy feature for IBM Z environments. A function of a storage server that assists a control program to maintain a consistent copy of a logical volume on another storage system. All modifications of the primary logical volume by any attached host are presented in order to a single host. The host then makes these modifications on the secondary logical volume. This function was formerly called *Extended Remote Copy* or *XRC*.

z/OS Management Facility (Z/OSMF):

Is a product for z/OS that simplifies, optimizes, and modernizes the z/OS system programmer experience

z/TPF:

Is an emulation of a computer system. Virtual machines are based on computer architectures and provide functionality of a physical computer.

z/VM:

A guest virtual machine (guest VM) is the software component of a virtual machine (VM), an independent instance of an operating system (called a guest operating system) and its associated software and information. A VM guest can be a Linux, z/OS, z/VSE, or another z/VM operating system.

z/VSE:

A general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible