Mainframe Developer Bootcamp

Course Summary

Description
As more of the so-called “Baby Boomer” generation retires, organizations are looking to replace legacy staff. ProTech has been training mainframe developers for over twenty-five years, most recently as part of IBM’s Academic Initiative.

This rigorous hands-on course is designed to mold students into competent developers utilizing instructor-led classroom discussion and real-world lab environment with a true z/OS mainframe system. Clients may also opt to have this course delivered using their own system.

This multi-week course can include a number of optional modules on various mainframe subsystems, customer-specific developer tools and life-cycle information. Additionally ProTech’s instructors can be retained for ongoing mentoring and project support.

Topics
- TSO/ISPF, JCL & Utilities (5)
- COBOL Application Programming (10)
- VSAM (5)
- DB2 Application Programming and Design (5)
- CICS/TS Command Level Application Programming (5) - Optional
- IMS Basic Programming Techniques (3) – Optional
- Developer tools - Optional

Audience
This course is intended for existing programmers who have not yet worked with the mainframe system, entry-level developers interested in starting their careers in COBOL development, or new-hires.

Prerequisites
Experience in programming concepts and at least one high-level language such as Java or C/C++ is beneficial but not required.

Duration
25-30 days (by option)
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Course Outline

I. MVS Overview
   A. zSeries & S/390 Operating Systems
   B. A Typical zSeries Data Center
   C. Real & Virtual Memory
   D. Multiprogramming vs. Multiprocessing
   E. Interrupts
   F. Bits and Bytes
   G. EBCDIC vs. ASCII
   H. The CPU (Central Processing Unit)
   I. MVS in a TCP/IP Network
   J. Understanding the Network Controllers
   K. Understanding the 3270 Terminal
   L. S/390 Printer Hardware Categories
   M. Storage Devices: DASD
   N. Storage Device Connections
   O. Storage Subsystems
   P. MVS Address Spaces
   Q. MVS Data Spaces
   R. z/OS 64 Bit Address Space
   S. MVS HiperSpaces
   T. MVS Dispatching
   U. MVS Customization
   V. The MCS Console
   W. MVS Data Management
   X. MVS Data Set Types
   Y. Sequential Datasets
   Z. Partitioned Datasets
   AA. VSAM Datasets
   BB. Systems Managed Storage (SMS)
   CC. Catalogs
   DD. VTOC: Volume Table of Contents
   EE. Tape Labels
   FF. Recovery / Termination Mgmt
   GG. SMF - System Management Facilities
   HH. Serialization: ENQ / DEQ
II. Shared DASD & Reserve/Release
   JJ. Security Overview
   KK. JES Overview
   LL. Job Life Cycle Phases
   MM. Job Execution Phase
   NN. JES2 vs. JES3
   OO. A Parallel Sysplex
   PP. UNIX System Services
   QQ. The UNIX Hierarchical File System
   RR. The UNIX Shell
   SS. Using the OMVS TSO Command
   TT. File Mgmt using the ISPF Shell
   UU. Program Products: CICS
   VV. Program Products: DB2

WW. Program Products: IMS
XX. Today's Application Architectures
YY. Program Products: WebSphere MQ
ZZ. What is a Job Scheduler?

II. TSO/E and ISPF Overview
   A. TSO/E Overview: Features
   B. TSO Operating Modes
   C. Interactive TSO Commands
   D. TSO/E Logon and Logoff
   E. TSO/E Line Mode
   F. ISPF/PDF Option 6
   G. Issuing TSO cmd from ISPF Panel
   H. TSO/E Command Syntax
   I. TSO/E PROFILE
   J. TSO/E REXX & CLIST
   K. Example REXX EXEC
   L. REXX Language Features
   M. Languages: Compiled vs. Scripting
   N. ISPF Overview
   O. What is a Panel?
   P. Menu Panel
   Q. List Panel
   R. EDIT PANEL
   S. ISPF Primary Option Menu
   T. Standard CUA Format
   U. ISPF Panel Terminology
   V. ISPF Hierarchy
   W. ISPF Panel Hierarchies
   X. ISPF Navigation
   Y. ISPF Line and Primary Commands
   Z. ISPF Primary Commands
   AA. ISPF Split Screen
   BB. ISPF Help

III. Navigating MVS Documentation
   A. IBM Library Reader on CD
   B. IBM Internet Library
   C. MVS/QuickRef Overview
   D. Abend Code Display
   E. Select Information By Category
   F. Sample JCL Information: NOTIFY
   G. Looking up an Error by Message ID
   H. Example Error Message Info: IOS000I
   I. Selecting Vendor, Product, Release
   J. Selecting DASD Free Space Information
   K. Displaying DASD Hardware
   L. Characteristics

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Course Outline (cont’d)

IV. ISPF Hierarchy & Settings
A. Primary Option Menu
B. Utility Selection Panel (=3)
C. Library Utility 3.1
D. Data Set Utility 3.2
E. Move Copy Utility 3.3
F. Data Set List Utility 3.4
G. ISPF Jump Function
H. Allocating Data Sets w/ ISPF
I. Data Set Allocation
J. Allocation Suggestions
K. ISPF Settings
L. PF Key Definitions and Labels
M. Keylist Utility
N. FKA / PFSHOW Example
O. Other ISPF Settings: Color, Environ

V. ISPF Edit and View
A. ISPF Edit, View, Browse
B. Edit Panel: Action Bar Choices
C. ISPF Edit Primary Commands
D. ISPF Edit Scroll Commands
E. Browse and Edit FIND command
F. Edit Change Command
G. Change Command Examples
H. FIND command: Advanced topics
I. Edit Session: Sequence Numbers
J. Special Editing Keys: Insert, Delete, & EOF
K. Line Edit Commands
L. Advanced Edit Line Commands
M. Text Entry mode
N. Text Flow Line Command
O. MASK and TS Line Command
P. Column and Data Shifting
Q. ISPF Edit Primary Commands
R. Locate Primary Commands
S. Delete Primary Commands
T. SORT Primary Command
U. COPY & MOVE Primary Commands
V. CUT & PASTE Primary Commands
W. Data Movement Commands
X. Nesting Edit

VI. SDSF Overview & Features
A. SDSF Primary Option Menu
B. SDSF Key End-User Commands
C. SDSF Input Queue Display
D. SDSF Input Action Characters
E. SDSF Active Display
F. SDSF Held Output Queue Display
G. SDSF Output Queue Display Cm
H. More SDSF Commands

VII. MVS Job Control Language
A. JCL Overview and Syntax
B. JCL Statement Types Covered
C. JCL Statement Categories
D. JCL Syntax: Fields
E. JCL Syntax: Parameters
F. JCL Syntax: Comments
G. JCL Syntax: Continuation
H. JES JCL Statements
I. JOB Statement
J. JOB Statement: Jobname
K. JOB Statement: Accounting Info
L. JOB Statement: Programmer-Name
M. JOB Statement: Apostrophe Rules
N. JOB Statement: Keyword Parameters
O. JOB Statement: CLASS Keyword
P. JOB Statement: MSGCLASS Keyword
Q. JOB Statement: MSGLEVEL Keyword
R. JOB Statement: NOTIFY Keyword
S. JOB Statement: TYPRUN Keyword
T. JOB Statement: RESTART Keyword
U. JOB Statement: Other Keywords
V. MVS Utilities: IEFBR14
W. EXEC Statement
X. Big Picture: Compile & Link Process
Y. EXEC Statement: PGM Keyword
Z. EXEC Statement: PROC Keyword
AA. EXEC Statement: PARM Keyword
BB. Using PARM in a COBOL Program
CC. EXEC Statement: TIME Keyword
DD. EXEC Statement: REGION Keyword
EE. EXEC Statement: COND Keyword
FF. DD Statement
GG. DD Statement: DDNAME
HH. Referring to the DDNAME in COBOL
II. DD Statement: SYSOUT=
JJ. DD Statement: * 
KK. DD Statement: DATA
LL. DD Statement: DUMMY
MM. MVS Utilities: IEBGENER

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Course Outline (cont’d)

A. Statement overview
B. Moving different data types
C. Downtill vs. Do-while
D. PERFORM statement
E. Goback statement

A. Reserved words
B. Compiler output improvement
C. Run time options

A. IF conditional statement
B. Conditional types
C. Nested conditionals
D. EVALUATE statement

A. Editing concepts
B. Numeric sign handling
C. Floating dollar signs

A. Batch vs. on-line
B. Real-time
C. Think-time
D. Transactions
E. Pseudo-conversational
F. Components, functions and features
G. Definitions
H. Tables

A. Program characteristics
B. Interface with CICS/TS
C. EXEC CICS/TS command format and argument conventions translator
D. Execute interface block

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Course Outline (cont’d)

XVIII. Program Structure
   A. Language considerations and restrictions
   B. Linkage section usage

XIX. Exception Processing
   A. Handle condition and Ignore condition
   B. Resp and Nohandle
   C. EIBRESP

XX. Program Control
   A. Modular structure using XCTL, LINK, CALL and RETURN
   B. Pseudo-conversational tasks using transid and commarea

XXI. Terminal Control
   A. SEND and RECEIVE
   B. Attention identifiers
   C. DFILAID
   D. HANDLEAID

XXII. File Control
   A. Random processing commands (read, update, delete, add)
   B. Browsing commands (start browse, read next, read previous, end or reset browse)
   C. Move mode (INTO) versus locate mode (SET)
   D. Exclusive control
   E. Syncpoint

XXIII. Basic Mapping
   A. Overview of BMS facilities
   B. Map creation (mapset definition macro, map definition macro, field definition macro)
   C. Attribute modification
   D. Cursor positioning
   E. mapping commands (SEND, RECEIVE)

XXIV. Transient Data and Temporary Storage
   A. Reading writing and deleting queues

XXV. Programming Considerations
   A. Access to system information (ADDRESS, ASSIGN)
   B. Abnormal termination and recovery (HANDLEABEND, ABEND, DUMP)
   C. Debugging facilities (CEDF)

XXVI. Entity Relationship Modeling
   A. Introduction to Database Design
   B. Defining the Mission
   C. Entity Relationships – Modeling and Diagrams
   D. Entity Relationship Diagrams - Notational Conventions
   E. Association Entities
   F. Drawings Guidelines
   G. EXERCISE - Entity Relationship Diagrams
   H. Data Elements and Primary Keys
   I. EXERCISE – Assign Data Elements and Primary Keys

XXVII. Normalization
   A. Introduction to Normalization
   B. First Cut
   C. Overview of Normal Forms
   D. First Normal Form (1NF)
   E. Second Normal Form (2NF)
   F. Third Normal Form (3NF)
   G. Derived Columns
   H. Logical Design Evaluation
   I. Benefits of Normalization
   J. Denormalization
   K. Referential Integrity
   L. Delete Concepts
   M. Insert and Update Implications
   N. Summary
   O. Transition from Logical to Physical
   P. EXERCISE –Normalization

XXVIII. DB2 Overview and Storage Concepts
   A. What is DB2?
   B. What is the History behind DB2?
   C. What are DB2’s Objectives?
   D. What is a Relational DBMS?
   E. What are DB2’s Features?
   F. Operational Environment

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Course Outline (cont’d)

G. SQL
H. Program Preparation Process
I. Unit of Recovery
J. Commit / Rollback
K. DB2 Terminology
L. Physical Hierarchy of DB2 Objects
M. Naming Conventions
N. Object Naming Conventions
O. Databases
P. DB2 and VSAM
Q. Storage Groups
R. Page Management
S. Tablespace
T. Segmented Tablespaces
U. Partitioned Tables
V. Base Tables
W. View Table
X. Synonym
Y. Indexes
Z. Stored Procedures and Functions
AA. DB2 String Data Types
BB. DB2 Numeric Data Types
CC. Data and Time Data Types
DD. Display Formats
EE. ROWID Data Type versus Identity Column
Attribute
FF. User-Defined Data Type
GG. DB2 Catalogs

XXIX. Basic SQL - SELECT
A. Table Names
B. Basic SELECT Statement
C. WHERE Clause
D. INEQUALITIES
E. Specific Column Selection
F. Case Expression
G. Derived Columns
H. Date and Time Usage
I. Common Special Registers
J. User Request #1
K. ORDER BY Clause - The Results Table Sort
L. Ordering Derived Columns
M. Order By and Fetch First n Rows ONLY
N. DISTINCT Operand
O. Expanding on the WHERE Clause
P. Multiple Conditions
Q. BETWEEN Clause
R. IN Clause
S. LIKE Clause
T. User Request #2
U. Negative logic
V. NULLS
W. IS DISTINCT FROM
X. Types of Built-In Functions
Y. Aggregate Functions
Z. Functions Involving NULL Values
AA. NULL Values are Considered In
BB. User Request # 3
CC. Scalar Functions
DD. CHAR
EE. Date or Time
FF. Hour, Minute, Second, Year, Month, Day
GG. Days
HH. Decimal
II. ROUND
JJ. TRUNC
KK. Digits
LL. Integer
MM. CAST
NN. COALESCE
OO. UPPER and LOWER
PP. Strip
QQ. POSSTR
RR. Substr
SS. Concatenation
TT. GROUP BY Clause
UU. HAVING Clause
VV. User Request # 4

XXX. Advanced SQL - SELECT
A. Join
B. Inner Join
C. Full Outer Join
D. Left - Right Outer Join
E. Joins of More Than 2 Tables
F. User Request # 5
G. Subquery
H. Single Value Subquery
I. Multivalued Subqueries
J. Multivalued Subqueries - ALL
K. Multivalued Subqueries - ANY or SOME
L. Multiple Column Subqueries
M. User request # 6

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Course Outline (cont’d)

N. Correlated Subqueries
O. Correlated Subqueries - Exists
P. Using Correlation Variables to Check R.I.
Q. Nested table Expression
R. Union
S. Union All
T. Rules for Union
U. Performance Considerations
V. INTERSECT
W. EXCEPT
X. User Request #7

XXXI. Update Data Manipulation
A. Insert
B. Update
C. SELECT FROM UPDATE
D. Delete
E. Truncate
F. SELECT FROM Delete
G. merge
H. DB2 Valid SQL Return Codes for Updating
I. Creating DB2 Objects using Data Definition Language
J. Structured Query Language (SQL)
K. DDL - Create Table Statement
L. Identity Column
M. Check Constraints
N. Alter Table Statement
O. Not NULL with Default
P. Referential Integrity
Q. Synonyms
R. Deleting DB2 Objects
S. Index
T. Unique Versus Non-Unique Indexes
U. Cluster versus Non-Cluster Indexes
V. Cluster Index

XXXII. Index Create
A. Partitioned Table
B. Views
C. Creating Common Tables Expressions

XXXIII. Application Program Considerations
A. DB2 Program Components
B. DB2 Additions to a Program Structure
C. Delimiters
D. Program Storage - Host Variables
E. Program Storage - DCLGEN
F. DCLGEN Utility
G. Expanded Include Member
H. SQLCA - SQL Communication Area
I. SQLCA Field Definitions
J. SQLWarning Definition
K. Error Handling
L. Unit of Work in an Application Program
M. Commit
N. Overview of Cursor and Non-Cursor Processing
O. Non-Cursor Processing
P. DB2 to Host Language Data Type Conversion Chart
Q. Host Structures
R. Host Structure Arrays
S. How to Handle NULLS
T. Non-Cursor Exercise
U. Cursor Processing Overview
V. Declaring a Standard Cursor
W. Declaring a Static, Dynamic or Rowset Scrollable Cursor
X. OPEN Cursor
Y. FETCH Standard Cursor
Z. FETCH Scrollable Cursor
AA. FETCH Rowset Cursor
BB. Chapter Six - Application Program Considerations - continued
CC. Cursor Update or Delete
DD. CLOSE Cursor
EE. Set Level Update or Delete

XXXIV. Program Preparation, Bind and Locking
A. Overall Procedure
B. Precompile
C. DB2 to Host Language Translations
D. Bind Procedure
E. Bind Panel
F. Rebind and Free
G. Validate Option
H. Timestamp
I. Program Isolation
J. Lock Table
K. Lock Duration
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Course Outline (cont’d)

XXXV. Security
A. Security Overview
B. Resources and Users
C. Privileges
D. Implicit Versus Explicit
E. Grant
F. Revoke
G. Secondary Auth-ID
H. Role

XXXVI. Application Performance Considerations
A. Application Tuning - Performance
B. Application Tuning - Explain
C. DB2 Application Programming Labs
D. LAB 1 - Creating Tables
E. LAB 2 - Loading Tables
F. LAB 3 - DCLGEN
G. LAB 4 - Coding Exercise
H. Extra Challenge Problems - Optional for this Lab

XXXVII. Introduction to IMS Concepts
A. File structures
B. Hierarchial concepts
C. SEGMENT
D. FIELD
E. Sequence field
F. Search key
G. Parent
H. Child
I. Root segment
J. Database record
K. Twins
L. Maximums

XXXVIII. Basic Database Definition
A. The purpose
B. Components
C. DBD statement
D. DATASET statement
E. SEGMENT statement
F. FIELD statement
G. Other optional statements
H. LCHILD statement
I. XDFLD statement
J. Other required statements
K. DBDGEN statement
L. FINISH statement
M. END statement

XXXIX. Program Specific Block
A. The purpose
B. Application views
C. Control statements
D. PCB statement
E. Program Specific Block
F. SENSEG statement
G. SENFDL statement
H. PSBGEN statement

XL. Program Components
A. IMS and the program
B. IMS interface
C. Program setup overview
D. Program communication
E. blocks
F. ENTRY statement
G. CALL statement

XLI. Get Calls
A. GU
B. GN
C. GNP

XLII. Update Calls
A. Insert
B. Replace
C. Delete

XLIII. JCL Considerations
A. Compilation JCL
B. Execution JCL

XLIV. IMS Workshop
A. IMS workshop
B. Client
C. Consultant
D. Problem
E. Solution
F. Procedures
G. Database description
H. Useful Copy Book members

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