POI 3AZR27370 D
(PDS Code MGW)

PLAN OF INSTRUCTION
(Technical Training)

BUIC COMPUTER PROGRAMMING

KEESLER TECHNICAL TRAINING CENTER

25 March 1970

VOLUME 1
of 4 VOLUMES

LIST OF EFFECTIVE PAGES

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DEPARTMENT OF THE AIR FORCE
Hq, 3380th Technical School (ATC)
Keesler Air Force Base, Mississippi 39534
Volume 1

PLAN OF INSTRUCTION
3AZR27370 D
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FOREWORD

1. PURPOSE. This volume prescribes the qualitative requirements for Block I of Course 3AZR27370 D, BUIC Computer Programming, in terms of learning objectives (criterion and enabling) presented in the preferred teaching sequence, and shows their duration, support materials, and guidance. It was developed under the provisions of ATCR 52-7, Plan of Instruction, and ATCR 52-33, Instructional System Development.

2. COURSE DESCRIPTION. This course trains Air Force NCOs in the skills and knowledges needed by them to perform as BUIC III computer programmers. The course includes computer principles, computer mathematics, basic programming concepts and techniques, BUIC assembler language programming, and BUIC compiler language programming. It also includes analysis of the BUIC III System functional areas of air surveillance, information transfer, weapons, simulation, recording, control, and ADP/BCDP interface. On-equipment training includes preparation, assembly, and debugging of assembly and compiler language programs, adaptation data, and geography; use of simulation techniques to create an artificial environment for system testing; operation of ADP program for system testing and recording; reduction and analysis of test results; and use of the utility programs to construct, verify, and maintain the ADP master tapes.

3. COURSE FORM. Pages iii and iv describe instruction in terms of major subject areas and time allocation as shown in table III of the course chart. The six-hour day (360 minutes) includes 300 minutes for instruction in classroom/laboratory activities and 60 minutes for student administrative activities such as breaks, clean-up, and class change.

4. EQUIPMENT ALLOWANCES AND AUTHORIZATIONS. With the exception of the prime training vehicle which is authorized in the PC documents, equipment required to conduct this course is listed in Equipment Authorization Inventory Data Number 205CR. The following TAs apply:

TA 006	Organizational and Administrative Equipment
TA 014	Individual Training
TA 636	Film Library

OPR: Computer Systems Department
DISTRIBUTION: As directed by ATCR 52-7 and related local directives

5. REFERENCES. This Plan of Instruction is based on COURSE TRAINING STANDARD 3AZR27370 D, 22 December 1969 and COURSE CHART 3AZR27370 D, 21 February 1970.

FOR THE COMMANDER

ROSS A. BECKHAM, JR., Colonel, USAF
Chief, Operations Division

TABLE III – COURSE CONTENT – COURSE CHART 3AZR27370 D

HOURS PER DAY / WEEKS	1	2	3	4	5	6
1	Course Material - UNCLASSIFIED 90 Hours BLOCK I - Programming Principles Orientation (1 hr); Introduction to computer (5 hrs); Computer mathematics (13 hrs); Boolean logic (5 hrs); Basic problem solving techniques (6 hrs); Flowchart design and analysis (55 hrs); Measurement (5 hrs).					
2						
3						
4	Course Material - UNCLASSIFIED 78 Hours BLOCK II - Central Processor Programming I Introduction to AN/GSA-51A System (3 hrs); Basic instruction set (29 hrs); Comparison and logical instructions (10 hrs); Introduction to Compool programming (6 hrs); Shift, complex arithmetic, conditional branch, and repeat instructions (24 hrs); Measurement (6 hrs).					
5						
6	Course Material - UNCLASSIFIED 66 Hours BLOCK III - Central Processor Programming II Field and character search instructions (12 hrs); Mini-BUIC system (15 hrs); Floating point instructions (9 hrs); Special system oriented codes (9 hrs); Subroutines (9 hrs); Interrupt system (6 hrs); Measurement (6 hrs).					
7						
8	Course Material - UNCLASSIFIED 63 Hours BLOCK IV - Input/Output Programming Introduction (1 hr); Input/output communications (14 hrs); Programming terminal devices (45 hrs); Measurement (3 hrs).					
9						
10	Course Material - SECRET 33 hrs BLOCK V - BUIC System Analysis I Introduction (9 hrs)(S); Air surveillance (21 hrs)(S); Measurement (3 hrs)(U).					
11	Above titles are unclassified					

ATC FORM 449A SEP 63 PREVIOUS EDITIONS OBSOLETE.

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TABLE III – COURSE CONTENT – COURSE CHART 3AZR27370 D

HOURS PER DAY / WEEKS	1	2	3	4	5	6
11	Course Material - SECRET 36 Hours BLOCK VI - BUIC System Analysis II Weapons (18 hrs)(S); Information transfer (11 hrs)(S); Simulation (4 hrs)(U); Measurement (3 hrs)(U). Above titles are unclassified					
12				Course Material - UNCLASSIFIED 36 Hrs BLOCK VII - Utility Computer Programs Introduction (1 hr); Initialising UCP (5 hrs); UCP Control and service programs (6 hrs); Tape file maintenance (6 hrs); Assemblers (6 hrs); Adaptation (6 hrs); Utility maintenance system (3 hrs); Measurement (3 hrs).		
13						
14						
15	Course Material - UNCLASSIFIED 90 Hours BLOCK VIII - Program Testing and Analysis Introduction (1 hr); Startover, control, and ADP/BCDP interface (10 hrs); Test planning (11 hrs); BUIC exercise preparation system (BEPS) (16 hrs); Facility system (12 hrs); BUIC analysis and reduction system (BARS) (10 hrs); Master tape generation (6 hrs); Program error correction (12 hrs); Program report processing (6 hrs); Measurement (6 hrs).					
16						
17	Course Material - UNCLASSIFIED 42 Hours BLOCK IX - Compiler Language Techniques Introduction (3 hrs); Coding conventions and program construction (33 hrs); Measurement (4 hrs); Course critique and graduation (2 hrs).					
18						

ATC FORM 449A SEP 63 PREVIOUS EDITIONS OBSOLETE.

PLAN OF INSTRUCTION	COURSE TITLE: BUIC Computer Programming
BLOCK TITLE: Programming Principles	

1 LEARNING OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
	Wk1-Dy1	
1. Orientation	1	Training Methods L 1 hr Instructional Guidance The Instructor Supervisor will conduct the orientation. At the conclusion of the orientation, the student material required for the block will be distributed.
a. Welcome b. Chain of command c. Course description d. Testing procedures e. Remedial study f. Break schedule g. Sick call procedure h. Department policies i. Student critique policies		
2. Introduction to Computers	5	Instructional Materials C612-PROG-ST, Computer Principles, Student Text C613-PROG-WB, Computer Principles, Homework Exercises C617-PROG-WB, Computer Programming Principles, Classroom Exercises Film TF-5602A, Digital Computer Techniques (20 min) Film TF-5602F, Digital Computer Programming (20 min) Film FLC-1361, Memory Devices (20 min) Film FLC-346, Computer Programming (15 min)

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Equipment and Training Aids 16mm Movie Projector Training Methods Ds 4 hrs, F 1 hr Instructional Guidance Discuss the history and application of computers. Use a diagram to show how the storage devices, central processing unit, and input/output devices function in the system. Discuss the stored program concept. Use film where applicable to the discussion.
Without the aid of reference material, correctly answer at least 7 out of 10 multiple choice questions pertaining to the history and general applications of computers; to stored program concepts; and to the functions, purpose, characteristics, organization, and logical interaction of the elements of a typical digital computer (CTS para 1a(1); 1a(2)).	E Wk1-Dy2	
3. Computer Mathematics	13	Instructional Materials C612-PROG-ST, Computer Principles, Student Text C613-PROG-WB, Computer Principles, Homework Exercises C617-PROG-WB, Computer Programming Principles, Classroom Exercises Equipment and Training Aids Overhead Projector Training Methods Ds-Dm 5 hrs, P 8 hrs Instructional Guidance Establish the need for each numbering system and demonstrate the use of each system. Demonstrate each conversion process and assign
a. Given a set of 12 mixed numbers and a time of 30 minutes, correctly convert a minimum of nine numbers from one numbering system to another as follows:		

PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
(1) Convert two decimal numbers to octal (2) Convert two octal numbers to decimal (3) Convert two octal numbers to binary (4) Convert two binary numbers to octal (5) Convert two binary numbers to decimal (6) Convert two decimal numbers to binary The numbers converted in each operation will include at least one fractional or mixed number (CTS para 1b).	C (6) Wk1-Dy3	in-class exercises. Take up each number conversion process in the order listed in the learning objective. Assign homework exercises.
	(1)	Review homework and administer a short quiz.
b. Given 12 problems, each containing signed values in a specific numbering system, correctly solve at least nine of the problems within 35 minutes. The given problems will include: (1) Two octal addition problems (2) Two octal subtraction problems which require the direct method (3) Two octal subtraction problems which require the radix-minus-one complement method (4) Two binary addition problems (5) Two binary subtraction problems which require the direct method (6) Two binary subtraction problems which require the radix-minus-one complement method (CTS para 1c)	C (5) Wk1-Dy4	Demonstrate the correct arithmetic operation for each type of computation. Show that the addition process is the same for any numbering system except for the difference in the number of digits available. Demonstrate the direct and radix-minus-one complement methods of subtraction and explain why computers employ the latter type. Assign in-class and homework exercises.
	(1)	Review homework and administer a short quiz.
4. Boolean Logic	5	Instructional Materials

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		C612-PROG-ST, Computer Principles, Student Text C613-PROG-WB, Computer Principles, Homework Exercises C617-PROG-WB, Computer Programming Principles, Classroom Exercises Equipment and Training Aids Overhead Projector Training Methods Ds-Dm 2.25 hrs, P 2.75 hrs Instructional Guidance Demonstrate the methods of logically combining binary numbers and assign in-class exercises.
a. Given five pairs of binary numbers with each number limited to a maximum of five bits, use AND, OR, and EXCLUSIVE OR functions to correctly combine at least four of the number pairs within a period of five minutes (CTS para 1d).	C (1½)	
b. Given three diagrams which contain from five to eight logic symbols each, write Boolean equations which accurately describe at least two of the diagrams. The equations must be completed within a period of 25 minutes (CTS para 1d).	C (3½)	Explain the basic rules of Boolean algebra. Show how logic circuits can be described by Boolean equations. Assign in-class and homework exercises.
	Wk1-Dy5	
5. Basic Problem Solving Techniques	6	Instructional Materials C612-PROG-ST, Computer Principles, Student Text C613-PROG-WB, Computer Principles, Homework Exercises C617-PROG-WB, Computer Programming Principles, Classroom Exercises

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		Equipment and Training Aids Overhead Projector Training Methods Ds-Dm 2 hrs, P 4 hrs(2) Instructional Guidance Demonstrate the process of problem statement evaluation. Assign in-class and homework exercises.
a. Given a narrative description of a programming problem and a work period of 30 minutes, construct a decision table that accurately defines no less than 70% of the operations required (CTS para 1e; 1f; 1g).	C	
b. Code data in each of the following formats: (1) Numerical data: (a) Fixed point (b) Computer normalized floating point (c) BUIC format floating point (2) Literal data: (a) Hollerith (b) Binary Coded Decimal (BCD) (3) Logical data: (a) Boolean (b) Value (CTS para 1e)	E	Demonstrate the procedures for coding each type of item. Point out the advantages and disadvantages of each type of item and explain why each is required. Show how each type of item is stored in a computer word. Explain normal and complement methods of representing numerical data. Explain the function of the characteristic and mantissa in floating point data. Show the coding format for 6-bit Hollerith and BCD data. Show examples of Boolean and value type items. Assign in-class and homework exercises.
	Wk2-Dy1	
6. Flowchart Design and Analysis	55	Instructional Materials C612-PROG-ST, Computer Principles, Student Text C613-PROG-WB, Computer Principles, Homework Exercises C617-PROG-WB, Computer Programming Principles, Classroom Exercises

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
a. Given the student text and a set of programming problems which require the use of straight line, branching, table search, sort, insertion, deletion, merge, and array search routines; analyze the problems and draw flowcharts to show the operations required. A minimum grade of 70% is required (CTS para 1e; 1g; 1i).		Equipment and Training Aids Overhead Projector Training Methods Ds-Dm 18 hrs, P 37 hrs(2) Instructional Guidance Introduce terminal symbol, processing symbol, flow lines, and arrows. Demonstrate the Logical construction of a straight line flowchart. Assign in-class and homework exercises.
	C (6)	Introduce decision and connector symbols. Demonstrate the logical construction of a branching flowchart. Assign in-class and homework exercises.
	Wk2-Dy2	
	(6)	Review homework and administer a short quiz. Introduce annotation, I/O, and pre-defined process symbols. Continue with in-class exercises assigned the previous day. Introduce tabular storage concepts and demonstrate indexing. Assign in-class exercises and homework exercises.
	Wk2-Dy3	
	(6)	Review homework and administer a short quiz. Demonstrate the logical construction of a table search flowchart and assign in-class and homework exercises.

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
	Wk2-Dy4	
	(6)	Demonstrate the logical contruction of a table sort flowchart and assign in-class and homework exercises.
	Wk2-Dy5	
	(6)	Review homework, administer a short quiz, and complete assigned exercises. Demonstrate the construction of an insertion flowchart and assign in-class and homework exercises.
	Wk3-Dy1	
	(6)	Review homework, administer a short quiz, and complete assigned exercises. Demonstrate the construction of a deletion flowchart and assign in-class and homework exercises.
	Wk3-Dy2	
	(6)	Review homework, administer a short quiz, and complete assigned exercises. Demonstrate the construction of a merge flowchart and assign in-class and homework exercises.
	Wk3-Dy3	

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES		2 DURATION (HOURS)	3 SUPPORT MATERIALS AND GUIDANCE
		(3)	Demonstrate the use of multiple subscripts in indexing and show how tables can be used to simulate arrays. Assign in-class and homework exercises.
b. Given the student text and a correct flowchart, analyze the flowchart and correctly answer at least four out of five questions pertaining to: (1) The function of any specified block (2) The form of data at any specified point (3) The purpose of the flowchart The five questions must include at least one for each of the three areas identified above (CTS para 1h(1); 1h(2); 1h(3)).	C	(3) Wk3-Dy4	Outline the objectives of this lesson and assign in-class and homework exercises.
		(5)	Review homework, administer a short quiz, and complete assigned exercises.
c. Given the student text, a flowchart containing five errors, and the intended purpose of the flowchart; locate and correct at least four out of five errors in a period of 20 minutes (CTS para 1h(4)).	C	(1) Wk3-Dy5	Have students locate and correct errors in given flowcharts. Assign homework.
		(1)	Review homework and complete assigned exercises.
7. Measurement		5	Training Methods TW 4 hrs, Ds 1 hr

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PLAN OF INSTRUCTION (Continued)

1 LEARNING OBJECTIVES	DURATION (HOURS) 2	3 SUPPORT MATERIALS AND GUIDANCE
a. Written performance test	(4)	Instructional Guidance Brief students on examination procedures and administer the block test in accordance with current policies and directives.
b. Critique	(1)	Critique and test in accordance with current policies and directives.

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