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Outline and Bibliography for the 4-Week Q-7 Coding Course
TECHNICAL MEMORANDUM
(TM Series)

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Outline and Bibliography
for the 4-Week Q-7 Coding Course

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I. INTRODUCTION

A. BASIC ELEMENTS

1. Memory (large and small, T.M.)
2. Arithmetic Element
3. I.O. Element
4. Control Element (inst, program)

B. Q-7 ELEMENTS

1. Memory
   a. Computer word (parity)
   b. Construction and addressing
   c. Use as working storage medium
   d. Non-destructive read out
   e. Random access
   f. Memory buffer

2. Control Element
   a. Instruction control
      1. Decoding
      2. PT and OT time command generator
   b. Program control
      1. Program counter
      2. Address reg

3. Arithmetic element
   a. A - reg
   b. B - reg
c. Accumulator

1W

d. Adder

1P

e. Arithmetic operations (complement arithmetic, etc.)

2E, 2F

1. Complement arithmetic

2. All operations reduce to addition

3. Logical add and multiply

4. Dual arithmetic

1B

4. I.O.

a. Single channel operation

b. Types of

C. INTRODUCTION TO SYMBOLIC CODING

1. Symbolic as Opposed to Machine Code

1D, 3A

2. Coding Sheets (handouts)

II. NON-I/O MACHINE INSTRUCTIONS

A. BASIC INSTRUCTIONS

1. CAD, CSU, ADD, SUB, RST, LST, PST, ECH, STZ, HLT

2. Instruction Stepping vs. Director Address

3. Symbolic Tags, $, Ease of Programming

4. Write Program in Symbolic and Absolute

5. Convenient constants and R. C. Constants

B. BRANCH CLASS

1. Unconditional (BFX)

2. (Decision Making) Conditional
   
   HLM, HRM, HFM, HFZ
C. REMAINDER OF ADD CLASS INSTRUCTIONS
   TAD, TSU, LAD, CAM, DIM

D. COMPARE CLASS
   CMF, CML, CMR, CDF, CDR, CDL

E. INSTRUCTION AND ADDRESS MODIFICATION
   1. Address Modification
      AOR, XIN, XAC, ALX, STA, nBPXaa
   2. Instruction Modification (RC Instruction)

F. PARTIAL WORD MANIPULATION AND TESTING
   1. ETR, LDB, ADB, DEP, FCL
   2. CMF, CMF
   3. TOE, TTB

G. CYCLE, SHIFT AND SCALING
   1. DCL, DSL, DSR, ASL, ASR, LSR, RSR, SLR
   2. Scaling for Add and Subtract

H. SUBROUTINES
   1. STA(A), BPX
   2. Entrance Parameters, Exit Parameters, Statement Variable
   3. Saving Index Registers

J. MULTIPLICATION
   1. MUL, TMU
   2. Scaling

K. DIVISION
   1. DIV, TDV
   2. Scaling
I. AUGMENTED CONFIGURATION

1. 17 Bit Arithmetic
   ADDA, SUBA, ADDA, RSTA

2. Small Core and Test Memory Addressing

3. Address Mod
   AORA, XACA, STAA

II. OVERFLOW

III. COMPOOL AND TRANSLATOR

A. COMPOOL DEFINED TABLES AND ITEMS

1. Structure of Compool as a Table; Tables, Items, Scaling, Program Sections

2. How used by translator
   a. ITEM, TABLE, and PGM tag translation
   b. Introduction to pseudo instructions

   1. POS, RES
   2. MSK
   c. TOB, TTB, for items

B. TRANSLATOR FUNCTIONS

1. As an instruction translator

2. As an Assembler
   a. IDT, END, LOC, CPO, SYN, CON, MACROS
   b. Translate assembly instructions (pseudos)

EXAM 2
P.A.T. 2

IV. I/O OPERATIONS

A. INTRODUCTION
1. I/O Units

2. Information Flow

3. Single Channel

B. CARD MACHINES

1. Card Reader
   a. 24-word card image
   b. SEL LCD RD8 BM11 BM14
   c. LPCR button

2. Punch
   a. Review card image
   b. WRT, PER73, 74

3. Printer
   a. PER 51, 52, 53, 54, 55
   b. Review card image mechanics of printing

C. LIBRARY SUBROUTINES

1. SUDOR (SBR)

2. System Subroutines
   GI GO
   Tape image

D. DRUMS

1. Physical Characteristics
   Access time and transfer rate

2. Addressable
   a. SDR, SX, PER75, BM16
   b. Drum control register
   c. Failure of two successive WRT instructions
3. Non-Addressable (status)
   a. Read by status or status identity
   b. BSW25, CSW
   c. Logical destructive readout
      CD, OD status bits

4. Load from A.M. Drums

5. DRM CARD

E. TAPES

   1. Physical Characteristics
      a. Mechanics
      b. Word, record, file structure
      c. Load point, EOF, EOT
      d. Access time and transfer rate

   2. Tape Programming
      a. Read, write
      b. Positioning
         1. rewind, backspace
         2. tape ready, tape prepared
      c. Special characteristics
         1. 12 micro-second delay after SEL
         2. WRT Ø as illegal instruction
         3. CSW with KDS 2000000
         4. parity

   3. Coseal Tape Formats

F. I/O REGISTER AS AN I/O DEVICE

   Master Reset
VI. MAINTENANCE CONSOLE AND TEST MEMORY

A. TEST MEMORY AND COMPUTER CLOCK
   1. Permanent Program Storage
   2. Assign-Unassign
      a. Use of A, B switch registers
      b. Live register
   3. Computer Clock
      CAC, PERI4

B. MAINTENANCE CONSOLE
   1. Central Computer Control Panel
   2. Sense Switches
   3. Condition Lights
   4. A & B Switches
   5. Alarm Switches, Alarm Lights

EXAM 3
P.A.T. 3

VII. PROGRAM DESIGN

A. PROGRAM ORGANIZATION
   1. Sophistication vs. Ease of Debugging
   2. Space vs. Time

B. PROGRAM DOCUMENTATION

VIII. DEBUGGING AND TAPE FILE MAINTENANCE

A. DEBUGGING
   1. I T & T
   2. Memory Print
3. ETC (Eggleston's Tape Compare)
4. Load Coseal

B. TAPE FILE MAINTENANCE

IX. SYMBOLIC CORRECTOR

FINAL EXAM
BIBLIOGRAPHY

Ref. 1 FN-1567, A Guide to AN/FSQ-7 Computer Instructions

A. p. 11 Logical Elements
B. p. 13 Dual Arithmetic
C. p. 5-10 The SAGE Computer
D. p. 15-18 Machine Language
E. p. 18-20 Machine Timing
F. p. 20-24 I/O Operation Timing
G. p. 24-25 Memory Element
H. p. 25-26 Addressing
J. p. 29 Random Access
K. p. 29-30 Arithmetic Element
L. p. 30 A-Register
M. p. 30 B-Register
N. p. 30 Accumulator
P. p. 31 Adder Circuitry
Q. p. 31 Word Configuration
R. p. 31-32 Program Control Element
S. p. 32-33 Program Counter
T. p. 33 Address Register
U. p. 33-34 Index Registers and Right Accumulator
V. p. 35 I/O Address Counter and I/O Word Counter
W. p. 36 Drum Control Register
X. p. 37 I/O Buffer Register
Y. p. 37 Instruction Control Element
Z. p. 41 Selection Control Element and I/O Register

Ref. 2 SD-3216, Programming Data for the AN/FSQ-7, 8

B. p. 56 Sequence of Instruction Execution
C. p. 57 Indexing
D. p. 58 Configuration Control
E. p. 58-61 Number Representation (Q-7 only)
F. p. 62 Division
G. p. 63-65 I/O Processes
H. p. 66 Memory Units
J. p. 67 Test Memory
K. p. 68 Clock Register
L. p. 68 I/O Register
M. p. 68-75 Alarms and Parity Checking
Ref. 3  FN-6179 and supplements, Coseal Utility System for the Q-7
A. p. 93-159  Program Assembler
B. p. 23-32  Control Cards
C. p. 41-53  General Input
D. p. 54-73  General Output
E. p. 82-91  Tape and Card Formats
F. p. 244-252  Tape File Maintenance
G. p. 252-256  Eggleston Tape Compare
H. p. 310-325  Symbolic Corrector
J. p. 325-328  Memory Print
K. p. 328-339  I T & T
L. p. 339-344  Load Coseal

Ref. 4  N-11132, Scaling
A. p. 4  Maximum precision
B. p. 5-6  Addition and Subtraction
C. p. 7-10  Multiplication
D. p. 10-13  Division

Ref. 5  FN-5266  Indexing and Looping
Ref. 6  N-16410  Coseal Reference Sheets
Ref. 7  N-1'/813/000/00  Sample Coseal Printout
Ref. 8  N-11556, S1  Q-7 Idiosyncrasies
Ref. 9  FN-5197  Drum System
Ref. 10  FN-7/76  Tape Programming for the Q-7
Ref. 11  N-(L)-11393  Tape Instruction Chart - Q-7
Ref. 12  FN-518  Test Memory and I/O Units
   A. p. 1-10  Test Memory
   B. p. 11-19  I/O Units
Ref. 13  FN-LS-5394/069/00  91W Compool Table and Item Dictionary
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