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

10 March 1964

# TECHNICAL MEMORANDUM

(TM Series)

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

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OUTLINE

BIBLIOGRAPHY  
REFERENCE

I. INTRODUCTION

A. BASIC ELEMENTS

- |                                    |       |
|------------------------------------|-------|
| 1. Memory (large and small, T.M.)  | 1G    |
| 2. Arithmetic Element              | 1K    |
| 3. I.O. Element                    | 1F    |
| 4. Control Element (inst, program) | 1R,1Y |

B. Q-7 ELEMENTS

- |                                     |    |
|-------------------------------------|----|
| 1. Memory                           | 2H |
| a. Computer word (parity)           | 1Q |
| b. Construction and addressing      | 1H |
| c. Use as working storage medium    |    |
| d. Non-destructive read out         |    |
| e. Random access                    | 1J |
| f. Memory buffer                    |    |
| 2. Control Element                  |    |
| a. Instruction control              | 1Y |
| 1. Decoding                         |    |
| 2. PT and OT time command generator |    |
| b. Program control                  | 1R |
| 1. Program counter                  | 1S |
| 2. Address reg                      | 1T |
| 3. Arithmetic element               |    |
| a. A - reg                          | 1L |
| b. B - reg                          | 1M |

c.	Accumulator	1N
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	2A
A.	BASIC INSTRUCTIONS	
1.	CAD, CSU, ADD, SUB, RST, LST, FST, 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 (BPK)	
2.	(Decision Making) Conditional BLM, BRM, BFM, BFZ	

- 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 1U,5
    - 1. Address Modification  
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    - 2. Instruction Modification (RC Instruction)
  - F. PARTIAL WORD MANIPULATION AND TESTING 8
    - 1. ETR, LDB, ADB, DEP, FCL
    - 2. CMM, CDM
    - 3. TOB, TTB
  - G. CYCLE, SHIFT AND SCALING 4B
    - 1. DCL, DSL, DSR, ASL, ASR, LSR, RSR, SLR
    - 2. Scaling for Add and Subtract
- EXAM 1  
P.A.T. 1
- H. SUBROUTINES
    - 1. STA(A), BPX
    - 2. Entrance Parameters, Exit Parameters, Statement Variable
    - 3. Saving Index Registers
  - J. MULTIPLICATION 4C
    - 1. MUL, TMU
    - 2. Scaling
  - K. DIVISION 4D
    - 1. DIV, TDV
    - 2. Scaling

## L. AUGMENTED CONFIGURATION

1. 17 Bit Arithmetic  
ADDA, SUBA, ADDB, RSTA
2. Small Core and Test Memory Addressing 12A
3. Address Mod  
AORA, XACA, STAA

## M. 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 6,7
  - a. ITEM, TABLE, and PGM tag translation
  - b. Introduction to pseudo instructions 3A
    1. POS, RES
    2. MSK
  - c. TOB, TTB, for items

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1. As an instruction translator
2. As an Assembler 3B
  - a. IDT, END, LOC, CPO, SYN, CON, MACROS 3A
  - b. Translate assembly instructions (pseudos)

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P.A.T. 2

## IV. I.O. OPERATIONS 12B

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1. I/O Units
  2. Information Flow 1V, 1X, 1Z
  3. Single Channel
- B. CARD MACHINES
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    - a. 24-word card image 3E
    - b. SEL LDC RDS BSN11 BSN14
    - c. LFCR 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 3C, 3D
- D. DRUMS 9
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    - Access time and transfer rate
  2. Addressable
    - a. SDR, SDX, PER75, BSN16
    - b. Drum control register 1W
    - c. Failure of two successive WRT instructions

- 3. Non-Addressable (status)
  - a. Read by status or status identity
  - b. BSN25, CSW
  - c. Logical destructive readout  
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- 4. Load from A.M. Drums
- 5. DRM CARD 3A
- E. TAPES 10,11
  - 1. Physical Characteristics
    - a. Mechanics
    - b. Word, record, file structure
    - c. Load point, EOF, EOT
    - d. Access time and transfer rate
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    - b. Positioning
      - 1. rewind, backspace
      - 2. tape ready, tape prepared
    - c. Special characteristics
      - 1. 12 micro-second delay after SEL
      - 2. WRT  $\emptyset$  as illegal instruction
      - 3. CSW with RDS ~~200000~~
      - 4. parity
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2. Assign-Unassign
  - a. Use of A, B switch registers
  - b. Live register
3. Computer Clock  
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2. Sense Switches
3. Condition Lights
4. A & B Switches
5. Alarm Switches, Alarm Lights

EXAM 3  
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VII. PROGRAM DESIGN

A. PROGRAM ORGANIZATION

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2. Space vs. Time

B. PROGRAM DOCUMENTATION

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3K

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IX.	SYMBOLIC CORRECTOR	3H

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
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M.	p. 30	B-Register
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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

A.	p. 24-53	Alphabetic arrangement of instructions with detailed description of instruction action.
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-17813/000/00 Sample Coseal Printout
- Ref. 8 N-11556, S1 Q-7 Idiosyncrasies
- Ref. 9 FN-5127 Drum System
- Ref. 10 FN-5726 Tape Programming for the Q-7
- Ref. 11 N-(L)-11893 Tape Instruction Chart - Q-7
- Ref. 12 FN-5128 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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