



ΔEDITOR

APL FUNCTION AND DATA MAINTENANCE SYSTEM

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ABSTRACT

ΔEDITOR IS AN APL WORKSPACE CONTAINING A SET OF HIGHLY USEFUL APL FUNCTIONS FOR USE IN THE CONSTRUCTION, DEBUGGING, MODIFICATION AND MAINTENANCE OF APL WORKSPACES. FEATURES OF ΔEDITOR:

A POWERFUL COMMAND SET, INCLUDING ADD, DELETE, CHANGE, MOVE, COPY, MERGE, BUILD AND FIND FUNCTIONS.

EDITING OF BOTH APL FUNCTIONS AND DATA ARRAYS.

FLEXIBILITY - THREE LEVELS OF FUNCTION AND STORAGE REQUIREMENTS, GROUPED FOR EASY COPYING INTO AND DELETING FROM USER WORKSPACES.

DOCUMENTATION - USER MANUAL, HELP FUNCTION AND STORAGE REQUIREMENTS TABLE.

EASE OF USE - TERSE, EASY TO REMEMBER COMMAND NAMES WITH CONSISTENT SYNTAX.

1. INTRODUCTION

THIS DOCUMENT DESCRIBES ΔEDITOR, A SET OF COMMANDS TO SIMPLIFY THE PROBLEM OF APL CODE AND DATA MAINTENANCE. ΔEDITOR CONTAINS A COLLECTION OF EASILY REMEMBERED COMMANDS WHICH WE BELIEVE MANY APL USERS WILL FIND VERY CONVENIENT AND USEFUL.

THE NAMES OF ALL OBJECTS IN ΔEDITOR BEGIN WITH "Δ"; THUS INTERFERENCE WITH USER OBJECTS IS EASILY AVOIDED.

THE COMMANDS ARE GROUPED AS FOLLOWS:

GΔEB - BASIC SET OF 7 - REQUIRES ABOUT 8750 BYTES
GΔE - PRIMARY SET OF 16 - REQUIRES ABOUT 14050 BYTES
GΔEF - FULL SET OF 22 - REQUIRES ABOUT 17350 BYTES
GΔEH - HELP COMMAND + TEXT

THE BASIC SET OF 7 COMMANDS IS VERY POWERFUL. WITH IT ONE MAY ADD, DELETE, CHANGE AND LIST ELEMENTS OF ANY APL FUNCTION, DATA ARRAY OR DATA VECTOR. FIFTEEN ADDITIONAL COMMANDS ARE AVAILABLE TO CREATE A NEW APL FUNCTION OR DATA ARRAY; COPY, MOVE OR FIND TEXT OR ELEMENTS WITHIN AN OBJECT; MERGE OBJECTS, ETC. THE STRUCTURE IS OPEN ENDED. THE USER MAY ADD HIS OWN COMMANDS SINCE EACH COMMAND IS AN INDEPENDENT APL FUNCTION OPERATING ON A GLOBAL VARIABLE NAMED "ΔΔ".

THE DESIGN OBJECTIVES OF ΔEDITOR ARE CATEGORIZED AS FOLLOWS:

PRIORITY 1	FUNCTION
PRIORITY 2	USABILITY
PRIORITY 3	STORAGE UTILIZATION
PRIORITY 4	EASE OF MODIFICATION

2. STRUCTURE

THE ORGANIZATIONAL CONCEPT OF Δ EDITOR IS TO PROVIDE AN ASSIST TO THE COMMAND STRUCTURE OF APL. EACH COMMAND IN Δ EDITOR IS AN INDEPENDENT, RESPONSIVE FUNCTION, RETURNING THE USER TO APL COMMAND MODE WHEN COMPLETE. THE TARGET OF ALL COMMANDS IS A GLOBAL VARIABLE CALLED " $\Delta\Delta$ " WHICH CONTAINS A COPY OF THE APL OBJECT WHICH THE USER WISHES TO MODIFY.

THIS PSEUDO-APL COMMAND STRUCTURE ALLOWS THE USE OF ANY NATIVE APL FACILITY BETWEEN COMMANDS, AS WELL AS THE ABILITY TO EXTEND FUNCTION BY THE ADDITION OF USER-DEFINED APPLICATION-DEPENDENT FUNCTIONS. THE SYMBOL " Δ " WAS CHOSEN BOTH TO REDUCE CONFLICT WITH USER OBJECT NAMES AND PRESENT A UNIQUE COMMAND SYMBOL SIMILAR IN CONCEPT TO " \square ".

Δ EDITOR IS INTENDED TO BE BROUGHT INTO A USER'S WORKSPACE WHEN MODIFICATIONS ARE REQUIRED AND THEN DELETED DURING PROGRAM EXECUTION IF STORAGE SPACE IS LIMITED. BECAUSE STORAGE IS OFTEN AT A PREMIUM, Δ EDITOR IS PACKAGED INTO THREE DISTINCT GROUPS, EACH GROUP A SUPERSET OF THE PREVIOUS ONE. THERE IS A BASIC SET OF SEVEN COMMANDS, $G\Delta EB$, WHICH OCCUPIES ABOUT 8750 BYTES OF STORAGE. THERE IS A PRIMARY SET, $G\Delta E$, CONTAINING THE SIXTEEN MOST FREQUENTLY USED COMMANDS, OCCUPYING ABOUT 14050 BYTES OF STORAGE. FINALLY, THERE IS A FULL SET, 22 COMMANDS, OCCUPYING ABOUT 17350 BYTES OF STORAGE. IN ADDITION, THERE IS A HELP COMMAND GROUP WHICH STANDS BY ITSELF, OCCUPIES ABOUT 10100 BYTES OF STORAGE, WHICH CAN BE REFERENCED WHEN THE USER FORGETS HOW A COMMAND FUNCTIONS.

CHAPTERS 3, 4 AND 5 OF THIS PAPER DESCRIBE THE FIRST THREE GROUPS, BOTH GENERALLY AND IN TERMS OF A USING ENVIRONMENT, BUILDING ON PREVIOUS KNOWLEDGE WITH EXAMPLES. CHAPTER 6 DESCRIBES THE HELP COMMAND. CHAPTERS 7 AND 8 GIVE ADDITIONAL USEFUL INFORMATION AND PROGRAMMING TIPS. THE ENTIRE COMMAND SET IS SUMMARIZED IN THE APPENDIX.

EACH Δ EDITOR COMMAND IS SHORT, TO MINIMIZE KEYSTROKES, AND OF A MNEMONIC FORM (FOR EXAMPLE, ΔL FOR LIST). PARAMETER LISTS ARE STANDARDIZED TO THE FULLEST EXTENT POSSIBLE TO ACHIEVE A HIGHLY USABLE SYSTEM WITH EXCELLENT FUNCTION.

3. THE BASIC SET, $G\Delta EB$, 7 COMMANDS.

TO CALL $G\Delta EB$ INTO A WORKSPACE:

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)COPY 29  $\Delta$ EDITOR  $G\Delta EB$ 
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THESE COMMANDS OCCUPY APPROXIMATELY 8750 BYTES. AN ADDITIONAL DATA AREA EQUAL TO THE SIZE OF THE DATA OBJECT OR THE CANONICAL (CHARACTER ARRAY) REPRESENTATION OF THE APL FUNCTION BEING EDITED IS REQUIRED FOR EXECUTION.

THE COMMANDS ARE:

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 $\Delta E$  'NAME'  PREPARE FOR EDITING (COPY OBJECT INTO  $\Delta\Delta$ )  
 $\Delta X$           EXIT FROM EDITING (RESTORE OBJECT FROM  $\Delta\Delta$ )  
  
 $\Delta L$  F [T]  LIST LINES F THROUGH T (INCLUSIVE)  
 $\Delta D$  F [T]  DELETE LINES F THROUGH T  
 $\Delta C$  F [T]  CHANGE DATA OBJECT WITHIN LINES F TO T  
 $\Delta G$  F [T]  GROUP (GLOBAL) CHANGE OF LINES F THROUGH T  
  
 $\Delta A$  B [N]  ADD N NEW LINES BEFORE LINE B
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BRACKETS [] INDICATE OPTIONAL PARAMETERS.

ΔE 'NAME'

ΔE 'NAME' SEARCHES FOR AN APL OBJECT NAMED "NAME". IF THE OBJECT IS NOT FOUND, AN ERROR MESSAGE IS RETURNED. THE OBJECT MAY BE AN APL FUNCTION, A TWO-DIMENSIONAL CHARACTER OR NUMERIC ARRAY, OR A NUMERIC VECTOR. ΔE CREATES A COPY OF "NAME", STORING IT IN THE DATA ARRAY ΔΔ. ALL SUBSEQUENT ΔEDITOR COMMANDS OPERATE ON ΔΔ, NOT ON THE ORIGINAL APL OBJECT. LINE NUMBERS ARE LOGICAL, NOT EXPLICITLY PART OF ΔΔ. THEY ARE CHANGED WHENEVER A COMMAND CHANGES THE NUMBER OF LINES OF THE OBJECT.

APL FUNCTION LINES ARE NUMBERED STARTING WITH [0] AS IN STANDARD APL USAGE. ARRAYS ARE NUMBERED STARTING WITH ROW [1]. NUMERIC VECTORS ARE ROTATED; THE NTH ELEMENT IN THE VECTOR IS TREATED AS LINE N.

AN ERROR MESSAGE IS RETURNED IF ρρNAME>2.

APL FUNCTIONS, CHARACTER ARRAYS AND NUMERIC VECTORS ARE STORED IN ΔΔ IN CHARACTER DATA FORM; NUMERIC ARRAYS IN NUMERIC FORM.

ΔX

ΔX CREATES (RESTORES) THE APL OBJECT FROM ΔΔ. IT RETURNS THE NAME OF THE APL OBJECT CREATED (RESTORED). THE ACTION WILL FAIL IF AN ATTEMPT IS MADE TO RESTORE EITHER A PENDENT (SUSPENDED) FUNCTION OR A FUNCTION CONTAINING UNBALANCED QUOTES. IN EITHER CASE, ΔX WILL RETURN A NUMBER WHICH IS THE ROW INDEX OF THE OFFENDING LINE. THE NUMBER IS "1" FOR PENDENT FUNCTIONS (HEADER LINE ERROR). IN THIS CASE, THE SUSPENSION MUST BE REMOVED [ENTER "+" UNTIL "SI" RETURNS A NULL MESSAGE] BEFORE ΔX WILL RESTORE.

ΔL F [T] [S] [E]

ΔL LISTS THE CONTENTS OF ΔΔ BEGINNING WITH LINE F AND TERMINATING WITH LINE T (IF GIVEN). IF T IS NOT GIVEN, ONLY LINE F IS LISTED. IF T IS TOO LARGE (GREATER THAN THE NUMBER OF LINES IN ΔΔ), THE LISTING RUNS FROM F TO THE END. IF F IS TOO LARGE, THE ENTIRE CONTENTS OF ΔΔ ARE LISTED, STARTING WITH THE NAME OF THE OBJECT.

FOR EXAMPLE, SUPPOSE THAT "JOE" IS AN APL OBJECT, NINE LINES LONG. "JOE" COULD BE A NINE ELEMENT NUMERIC VECTOR, A NINE LINE FUNCTION, OR A DATA ARRAY OF NINE ROWS BY AN ARBITRARY NUMBER OF COLUMNS.

```
ΔE 'JOE' PUTS A COPY OF "JOE" INTO ΔΔ
ΔL 5     LISTS LINE 5 OF ΔΔ
ΔL 2 4   LISTS LINES 2, 3 AND 4 OF ΔΔ
ΔL 6 99  LISTS ΔΔ FROM LINE 6 TO LINE 9
ΔL 99    LISTS ALL OF ΔΔ
ΔX       CONTENTS OF ΔΔ REPLACE OLD "JOE"
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IN THIS EXAMPLE, OF COURSE, THE NEW "JOE" IS THE SAME AS THE OLD "JOE" WHICH WAS REPLACED.

IF S IS GIVEN, THE LINE(S) LISTED BEGIN WITH COLUMN OR ELEMENT "S". IF E IS GIVEN, THE LINE(S) LISTED END WITH COLUMN OR ELEMENT "E"

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ΔL 2 4 7 LIST LINES 2-4 FROM COL 7 ON
ΔL 2 2 7 9 LIST COLS 7-9 OF LINE 2
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ΔD F [T]

ΔD DELETES LINES F THROUGH T (IF GIVEN) FROM $\Delta\Delta$. LINES REMAINING ARE RENUMBERED. CONTINUING THE EXAMPLE:

```
 $\Delta D$  4      DELETES LINE 4 OF  $\Delta\Delta$ 
 $\Delta D$  2 4    DELETES LINES 2, 3 AND 4 (NEW [4])
 $\Delta X$       CREATES A NEW "JOE" FROM  $\Delta\Delta$ 
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THE NEW "JOE" WILL BE JUST FIVE LINES LONG.

IF F IS OUT OF RANGE, AN ERROR MESSAGE IS RETURNED AND NO DELETION TAKES PLACE. IF T IS OUT OF RANGE, DELETION TAKES PLACE TO THE END OF THE OBJECT. IN ALL CASES, A CONFIRMATION MESSAGE IS RETURNED.

ΔC F [T]

ΔC (CHANGE PHRASE) CHANGES THE CONTENTS OF $\Delta\Delta$, BEGINNING WITH LINE F AND TERMINATING WITH LINE T (IF GIVEN). IF T IS NOT GIVEN, ONLY LINE F IS CHANGED. IF F IS OUT OF RANGE, AN ERROR MESSAGE IS RETURNED AND NO CHANGES ARE MADE. IF T IS OUT OF RANGE, CHANGES ARE MADE THROUGH THE LAST LINE.

ΔC PROMPTS FOR TEXT FROM THE KEYBOARD USING THE CHARACTER "<" (UPPER CASE Z) AS A DELIMITER. TO CHANGE, SAY, THE THREE CHARACTER PHRASE "ABC" TO THE FOUR CHARACTER PHRASE "WXYZ" IN ALL LINES FROM 3 TO 6, THE FOLLOWING SEQUENCE WOULD BE FOLLOWED:

```
 $\Delta C$  3 6
<ABC<WXYZ
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THE FIRST "<" IS RETURNED BY THE ΔC COMMAND; THE REMAINING INFORMATION MUST BE ENTERED BY THE USER. LINES 3, 4, 5 AND 6 WILL BE SCANNED FOR THE FIRST STRING "ABC" IN EACH. IF FOUND, THE LINE WILL BE LISTED WITH THE CHANGE MADE. A NULL RESPONSE TELLS ΔC TO ACCEPT THE CHANGE. ANY OTHER RESPONSE LEAVES THE LINE INTACT. ONLY THE FIRST "ABC" STRING IN EACH LINE IS CHANGED.

A NULL ENTRY FOR THE SECOND PHRASE RESULTS IN THE DELETION OF THE FIRST PHRASE. A NULL ENTRY AFTER THE FIRST "<" SIMPLY RESULTS IN AN EXIT FROM THE ΔC COMMAND WITH NO ACTION TAKEN.

SOME EXAMPLES:

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 $\Delta C$  1 99      CHANGE EACH LINE OF  $\Delta\Delta$ 
<ABC<WXYZ      "ABC" IS REPLACED BY "WXYZ"
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 $\Delta C$  5 99      CHANGE FROM LINE 5 TO THE END OF  $\Delta\Delta$ 
<[PDQ]<(RST)    "[PDQ]" REPLACED BY "(RST)"
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 $\Delta C$  6          CHANGE IN LINE 6 ONLY
<PDQ<           DELETE "PDQ" FROM LINE 6
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WHEN THE PHRASES ARE OF DIFFERENT LENGTHS, THE LINE TEXT IS EXPANDED OR CONTRACTED ACCORDINGLY. IF THE NEW LINE IS LARGER THAN THE PREVIOUS ARRAY WIDTH, THE ARRAY WIDTH IS EXPANDED. FOR CHARACTER ARRAYS, A MESSAGE IS RETURNED WARNING THE USER THAT ACCEPTANCE OF THE LINE WILL RESULT IN AN ARRAY WIDTH CHANGE. THIS MESSAGE IS SUPPRESSED UNDER CERTAIN CONDITIONS; SEE NOTE D IN CHAPTER 7.

ΔG F [T]

ΔG (GROUP OR GLOBAL CHANGE) IS SIMILAR TO ΔC, BUT MORE POWERFUL. IT CHANGES THE CONTENTS OF ΔΔ BEGINNING WITH LINE F AND ENDING WITH LINE T (IF GIVEN). IF T IS NOT GIVEN, ONLY LINE F IS CHANGED. IF F IS OUT OF RANGE, AN APPROPRIATE ERROR MESSAGE IS RETURNED AND NO CHANGES ARE MADE. IF T IS OUT OF RANGE, CHANGES ARE MADE THROUGH THE LAST LINE.

ΔG PROMPTS FOR TEXT IN THE SAME MANNER AS ΔC. THE DIFFERENCE IS THAT MULTIPLE CHANGES ARE PROMPTED UNTIL A NULL ENTRY (CARRIAGE RETURN ONLY) IS ENTERED IN RESPONSE TO THE PROMPTING "c". A SECOND DIFFERENCE IS THAT ΔG CHANGES ALL OCCURRENCES, NOT JUST THE FIRST, OF THE PROMPTED PHRASES.

EXPANSION AND CONTRACTION OF LINES AND EXPANSION OF THE ARRAY SIZE MAY OCCUR AS IN ΔC.

SOME EXAMPLES:

ΔG 1 99	CHANGE PHRASE(S) IN ALL LINES
cABC<DEFG	FIRST PHRASE; "DEFG" REPLACES "ABC"
cLMN<BC	SECOND PHRASE; "BC" REPLACES "LMN"
c (CARRIAGE RETURN)	EXIT FROM PROMPT
ΔG 6	CHANGE(S) TO LINE 6 ONLY
cABC<	DELETE "ABC"
c	EXIT FROM PROMPT
ΔG 7 9	CHANGE PHRASE(S) IN LINES 7 THRU 9
cLABL1<LABL6	"LABL6" REPLACES "LABL1"
c	EXIT FROM PROMPT

ΔA B [N]

ΔA (ADD) ALLOWS THE ADDITION OF N LINES BEFORE LINE B OF ΔΔ. IF N IS NOT SPECIFIED, IT IS DEFAULTED TO INFINITY (999). IF B IS LARGER THAN THE ROW INDEX OF ΔΔ, ADDITIONS ARE MADE TO THE END OF ΔΔ. EACH NEW LINE IS PROMPTED; A NULL ENTRY (CARRIAGE RETURN) TERMINATES OPERATION. CONTINUING THE EXAMPLE:

ΔA 3 2	ALLOWS ≤2 NEW LINES BEFORE LINE 3
[3] NEW LINE TEXT	PROMPTED BY[3]
[4] NEW LINE TEXT	PROMPTED BY[4] (THE OLD LINE 3 IS NOW LINE 5)
ΔA 99	ALLOW ADDITIONS TO THE END OF ΔΔ
[8] NEW LINE TEXT	
[9] (CARRIAGE RETURN)	TERMINATE ΔA

AT THIS POINT, ΔΔ HAS 8 LINES CONSTRUCTED. ANOTHER ΔX WILL CREATE ANOTHER NEW "JOE" FROM ΔΔ, REPLACING THE OLD "JOE".

FOR NUMERIC VECTORS, MULTIPLE ELEMENTS MAY BE ADDED IN A SINGLE LINE ENTRY. FOR EXAMPLE, TO ADD THREE NEW ELEMENTS "10 16 2" BETWEEN THE 7TH AND 8TH ELEMENTS OF AN EXISTING (IN ΔΔ) VECTOR:

ΔA 8	
[8] 10 16 2	THREE ELEMENTS ADDED AFTER PROMPT
[11] (CARRIAGE RETURN)	TERMINATE

NOTE THAT A PROMPT WAS GIVEN FOR A NEW 11TH ELEMENT; MORE ADDITIONS COULD HAVE BEEN MADE AT THIS POINT.

FOR NUMERIC OBJECTS, ANY VALID APL PHRASE, "608" FOR EXAMPLE, MAY BE USED. FOR NUMERIC ARRAYS, AN ERROR MESSAGE IS RETURNED IF AN IMPROPER NUMBER OF ELEMENTS IS ENTERED FOR A LINE.

FOR CHARACTER ARRAYS, ARRAY WIDTH EXPANSION MAY OCCUR AS DESCRIBED IN ΔC ABOVE.

4. THE PRIMARY SET. GΔE. 16 COMMANDS.

NINE COMMANDS ARE ADDED TO GΔEB TO FORM THE PRIMARY SET OF ΔEDITOR FUNCTIONS. TO USE THESE:

)COPY 29 ΔEDITOR GΔE

GΔE OCCUPIES ABOUT 14050 BYTES OF STORAGE PLUS THE SIZE OF ΔΔ, ABOUT 5300 BYTES MORE THAN GΔEB. THE 9 ADDITIONAL COMMANDS ARE:

ΔB	'NAME'			BUILD NEW OBJECT
ΔF				FIND PHRASE
ΔS				STATUS REPORT
ΔR	F	[T]		REPLACE LINE(S)
ΔCO	F	T	B	COPY LINE(S)
ΔME	F	T	B	MERGE LINE(S) FROM ANOTHER OBJECT
ΔMV	F	T	B	MOVE LINE(S)
ΔI	B	N		INSERT LINE(S)
ΔW	B	N		WIDTH CHANGE

ΔB 'NAME'

ΔB (BUILD) IS USED TO CREATE A NEW APL OBJECT WHOSE NAME IS THAT GIVEN AS A PARAMETER OF ΔB. IF THE NAME IS ALREADY DEFINED, AN ERROR MESSAGE IS RETURNED. THE USER IS PROMPTED TO ENTER THE APL OBJECT TYPE; THEN LINES ARE PROMPTED AS THEY ARE IN ΔA. THERE IS ONE DISTINCTION; IN THE EVENT A CHARACTER ARRAY IS BEING CONSTRUCTED, NO ERROR MESSAGES WILL BE RETURNED WHEN THE ARRAY WIDTH CHANGES (DUE TO THE ENTRY OF A LONGER LINE). THIS SUPPRESSION WILL REMAIN IN EFFECT FOR ALL SUBSEQUENT COMMANDS UNTIL ANOTHER ΔE IS EXECUTED.

ΔB 'BECKI'	BUILD A NEW OBJECT NAMED "BECKI"
F C NA OR NV: F	COMMAND RETURNS "F C NA OR NV"
	USER ENTERS "F" (FOR FUNCTION)

FOLLOWING THE MESSAGE "F C NA OR NV", THE USER IS EXPECTED TO ENTER:

"F" FOR AN APL FUNCTION
 "C" FOR A CHARACTER ARRAY
 "NA" FOR A NUMERIC ARRAY, OR
 "NV" FOR A NUMERIC VECTOR

IF ΔB DETERMINES THAT A NAME IS A VALID FUNCTION NAME (BY A BLANK, SEMICOLON OR LEFT ARROW ENCOUNTER), THE PROMPT MESSAGE IS BYPASSED. IF THE NEW OBJECT IS A FUNCTION, THE 0TH (HEADER) LINE IS LISTED, FOLLOWED BY A PROMPT "[1]" FOR THE FIRST LINE.

ΔF

ΔF (FIND PHRASE) HAS NO PARAMETER LIST. THE USER IS PROMPTED FOR INPUT OF A PHRASE. IT RETURNS THE LINE NUMBER(S) WHERE THE PHRASE EXISTS IN ΔΔ (OR A "NOT FOUND" MESSAGE IF NO LINES CONTAIN THE PHRASE).

ΔF	
cXYZ	THE COMMAND RETURNS "c"; THE USER ENTERS "XYZ"
[17 22]	SHOWS "XYZ" OCCURS IN LINES 17 AND 22

ΔS

ΔS, WHICH HAS NO PARAMETER LIST, IS USED TO DISPLAY THE CURRENT STATUS OF THE OBJECT IN ΔΔ. A TYPICAL OUTPUT:

ΔS
23 34 ANNA=2 c

WHICH INDICATES THAT THE CURRENT APL OBJECT BEING EDITED IS TYPE 2 (A CHARACTER ARRAY) OF 23 ROWS BY 34 COLUMNS; THAT ITS NAME IS "ANNA" AND THAT THE CURRENT DELIMITER SYMBOL IS "c". (TO CHANGE THE DELIMITER SYMBOL, SEE "ΔDELIM" NOTES BELOW).

IF THE OBJECT IS A NUMERIC VECTOR, THE FORMAT OF THE MESSAGE IS:

22 1 (4) ANNA=4 c

WHICH INDICATES A NUMERIC VECTOR OF 22 ELEMENTS WHOSE CHARACTER REPRESENTATION IS 4 CHARACTERS WIDE.

ΔR F [T]

ΔR (REPLACE LINES) COMBINES THE FUNCTIONS OF ΔD (DELETE) AND ΔA (ADD). IF T IS ABSENT, ONLY LINE F WILL BE REPLACED. THE NEW LINES WILL BE PROMPTED BY APPROPRIATE LINE NUMBERS ENCLOSED IN BRACKETS. ONE MAY EXIT FROM ΔR AT ANY TIME BY A NULL ENTRY, EVEN THOUGH ALL OF THE LINES HAVE NOT BEEN REPLACED.

ARRAY WIDTH EXPANSION IS HANDLED AS IN ΔA.

TO CONTINUE OUR EXAMPLE OF EDITING "JOE":

ΔR 3 4 REPLACE LINES 3 AND 4

[3] ENTER NEW LINE TEXT
[4] (CARRIAGE RETURN) DECIDE NOT TO REPLACE LINE 4

AT THE END OF THIS SEQUENCE, LINE 3 OF ΔΔ HAS BEEN REPLACED; LINE 4 HAS NOT.

ΔCO F T B

ΔCO (COPY) COPIES LINES F THROUGH T BEFORE LINE B. THE SIZE OF ΔΔ IS INCREASED BY THE NUMBER OF LINES COPIED, THE ORIGINAL LINES ARE NOT ERASED, BUT THEY ARE RENUMBERED IF THE COPIED LINES ARE PLACED ABOVE THE ORIGINALS. FOR EXAMPLE:

ΔCO 3 5 2

COPIES LINES 3, 4 AND 5 OF ΔΔ BETWEEN LINES 1 AND 2. THE ORIGINAL LINE 2 BECOMES LINE 5. THE SIZE OF ΔΔ INCREASES BY 3 LINES. LINES 2, 3 AND 4 ARE NOW IDENTICAL TO LINES 6, 7 AND 8.

A MESSAGE IS RETURNED VERIFYING THE COPY OR INDICATING NO COPY IF F IS OUT OF RANGE. IF T IS OUT OF RANGE, T IS DEFAULTED TO LAST LINE. IF B IS OUT OF RANGE, THE COPY IS TO THE END OF THE OBJECT.

ΔME F T B

ΔME (MERGE) IS SIMILAR TO ΔCO (COPY) EXCEPT THAT THE LINES F THROUGH T TO BE MERGED BEFORE B WILL COME, NOT FROM ΔΔ, BUT FROM SOME OTHER LIKE APL OBJECT IN THE WORKSPACE. THE NAME OF THE APL OBJECT WILL BE PROMPTED. FOR EXAMPLE:

ΔME 7 9 18
FROM=SAM COMMAND RETURNS "FROM="; USER ENTERS "SAM"

WILL MERGE LINES 7, 8 AND 9 FROM "SAM" BEFORE LINE 18 OF ΔΔ. THE SIZE OF ΔΔ WILL INCREASE BY 3 LINES. "SAM" IS NOT CHANGED. THE OLD LINE 18 OF ΔΔ IS NOW RENUMBERED TO 21.

IF "SAM" IS NOT THE SAME OBJECT TYPE AS ΔΔ, AN ERROR MESSAGE IS RETURNED. A MESSAGE IS RETURNED VERIFYING THE MERGE OR INDICATING NO MERGE IF F IS OUT OF RANGE. IF T IS OUT OF RANGE, T IS DEFAULTED TO LAST LINE. IF B IS OUT OF RANGE, THE MERGE IS TO THE END OF THE OBJECT.

ΔMV F T B

ΔMV (MOVE) IS SIMILAR TO ΔCO (COPY) EXCEPT THAT THE LINES F THROUGH T ARE ACTUALLY TAKEN FROM THEIR ORIGINAL POSITION IN ΔΔ AND PLACED BEFORE LINE B. AS A RESULT, THE SIZE OF ΔΔ IS NOT CHANGED BY A ΔMV COMMAND.

ONE USE OF ΔMV IS TO INTERCHANGE TWO LINES. TO INTERCHANGE LINE 4 WITH LINE 16,

ΔMV 4 4 16
ΔMV 16 16 4

A MESSAGE IS RETURNED VERIFYING THE MOVE OR INDICATING NO MOVE IF F IS OUT OF RANGE. IF T IS OUT OF RANGE, T IS DEFAULTED TO LAST LINE. IF B IS OUT OF RANGE, THE MOVE IS TO THE END OF THE OBJECT.

ΔI B N

ΔI (INSERT LINES) ENLARGES THE SIZE OF ΔΔ BY INSERTING N BLANK OR ZERO LINES BEFORE LINE B. IF B IS TOO LARGE, ΔI WILL DEFAULT TO ADDING BLANK OR ZERO LINES TO THE END.

ΔI 99 7 ADDS 7 BLANK/ZERO LINES TO END OF ΔΔ
ΔI 3 5 ADDS 5 BLANK/ZERO LINES BEFORE LINE 3

ΔW B N

ΔW (WIDTH CHANGE) MODIFIES THE WIDTH OF ΔΔ BY INSERTING N BLANK OR ZERO COLUMNS, OR DELETING COLUMNS, TO THE RIGHT OF COLUMN B. IT INSERTS TO THE EXTREME RIGHT IF B IS TOO LARGE. IF B IS ZERO, THE COLUMNS ARE ADDED TO THE EXTREME LEFT. ΔW ADDS COLUMNS IF N IS POSITIVE; DELETES COLUMNS IF N IS NEGATIVE. FOR EXAMPLE:

ΔW 17 -3

WILL DELETE COLUMNS 18, 19 AND 20 FROM ΔΔ, REDUCING THE WIDTH BY THAT AMOUNT.

5. THE FULL SET, GAEF, 22 COMMANDS.

SIX COMMANDS ARE ADDED TO GAE TO FORM THE FULL SET OF ΔEDITOR COMMANDS. TO USE THESE:

)COPY 29 ΔEDITOR GAEF

THE STORAGE REQUIREMENT TO USE GAEF OVER GAE IS ABOUT 3300 BYTES. GAE OCCUPIES ABOUT 17350 BYTES OF STORAGE PLUS THE SIZE OF THE OBJECT TO BE EDITED. THE ADDITIONAL COMMANDS ARE:

ΔDELIM
ΔCW

ΔDP F [T]
ΔFC F [T]
ΔRC F [T]
ΔRN F [T]

ΔDELIM

ΔDELIM ALLOWS THE USER TO CHANGE THE DELIMITER PROMPTING SYMBOL. SUCH A CHANGE IS NEEDED IF THE USER WISHES TO MODIFY A PHRASE CONTAINING A "c". ONCE CHANGED, THE NEW SYMBOL REMAINS IN EFFECT UNTIL CHANGED BY ANOTHER ΔDELIM COMMAND.

ΔDELIM 'α' CHANGES THE DELIM CHAR TO "α"
DELIMITER WAS c NOW α MESSAGE RETURNED BY COMMAND

ANY VALID APL CHARACTER CAN BE USED FOR THIS PURPOSE.

ΔCW

ΔCW (CHANGE WORKSPACE) OPERATES ONLY ON APL FUNCTIONS. ITS ACTION IS SIMILAR TO "ΔG 99"; IT WILL MAKE THE PROMPTED PHRASE SUBSTITUTION(S) ON ALL APL FUNCTIONS IN THE WORKSPACE. BYPASSING ONLY THOSE FUNCTIONS (PRESUMABLY ΔEDITOR FUNCTIONS) WITH A "Δ" IN THEIR NAME. THE CONTENTS OF ΔΔ WILL BE DESTROYED. THE PRIMARY USE OF THIS COMMAND IS TO CHANGE THE NAMES OF GLOBAL VARIABLES AS USED BY FUNCTIONS IN A WORKSPACE. AS WITH ΔC AND ΔG, EACH CHANGE IS DISPLAYED BEFORE IT IS MADE; ANY NON-NUL RESPONSE FROM THE USER TO THE DISPLAY NEGATES THE CHANGE.

ΔDP F [T]

ΔDP (DELETE PHRASE) IS A VARIATION ON ΔC, USEFUL WHEN THE CHANGE DESIRED CONSISTS ONLY OF PHRASE DELETION AND THE PHRASE IS FAIRLY LONG. AS WITH ΔC, F AND T DELIMIT THE LINES OF ΔΔ WHICH WILL BE SCANNED FOR THE FIRST OCCURRENCE OF THE PHRASE. THE COMMAND WILL PROMPT FOR THE BEGINNING AND ENDING TEXT STRINGS OF THE PHRASE. FOR EXAMPLE, SUPPOSE WE WISH TO REMOVE THE TEXT "ABLE+BAKER" IN LINE 7 THROUGH 23 OF ΔΔ:

ΔDP 7 23
cABLcKER COMMAND RETURNS "c"; USER ENTERS "ABLcKER"

WILL ACCOMPLISH THIS JOB. (SO WOULD cAcr). NOTE THAT IT WILL ALSO DELETE PHRASES SUCH AS "ABLKER" AND "ABL5+3+PKER" FROM THESE LINES. AS IN ΔC, THE USER WILL BE PROMPTED FOR ACCEPTANCE BEFORE A CHANGE IS MADE.

ΔFC F [T]

ΔFC (FIND STARTING COLUMN) SCANS LINES F THROUGH T FOR THE FIRST OCCURRENCE OF A PROMPTED PHRASE. IN THIS RESPECT, IT IS LIKE ΔF. UNLIKE ΔF, HOWEVER, IT RETURNS NOT ONLY THE LINE NUMBERS IN ΔΔ WHERE THE PROMPTED PHRASE OCCURS, BUT ALSO THE STARTING COLUMN NUMBER WITHIN EACH LINE.

ΔFC 6
C=ABC

RETURNS:

[6] C=8

INDICATING THAT "ABC" STARTS AT COLUMN 8 IN LINE 6.

ΔRC F [T]

ΔRC (REPLACE COLUMN) IS USED TO REPLACE TEXT IN LINES F THROUGH T STARTING WITH A PARTICULAR COLUMN NUMBER WHICH WILL BE PROMPTED. THERE IS NO MATCHING OF PHRASES; ALL TEXT ENTERED IS PUT INTO ΔΔ STARTING WITH THE SPECIFIED COLUMN. IF THE PROMPTED COLUMN IS TOO LARGE, THE REPLACEMENT IS APPENDED TO THE END (RIGHTMOST NON-BLANK) OF THE LINE. IF F IS TOO LARGE, AN ERROR MESSAGE IS RETURNED. IF T IS TOO LARGE, THE REPLACEMENT APPLIES TO ALL LINES IN ΔΔ FROM F TO THE END.

ΔRC 3 CHANGE IS TO LINE 3 ONLY
COL=7 COMMAND RETURNS "COL="; USER ENTERS "7"
[3] C=7 TEXT COMMAND RETURNS "[3] C=7";
 USER ENTERS "TEXT"

ARRAY WIDTH EXPANSION IS HANDLED AS IN ΔC.

IF THE REPLACEMENT OVERWRITES EXISTING TEXT, THE MODIFIED LINE IS PRESENTED FOR ACCEPTANCE AS IN ΔC. IF THE REPLACEMENT OVERWRITES ONLY BLANKS, AND THERE IS NO TEXT TO THE RIGHT OF THE REPLACEMENT, NO VERIFICATION IS REQUESTED.

ΔRN F [T]

ΔRN (REPLACE NUMERIC) IS USED TO REPLACE A SINGLE ROW OR COLUMN IN A NUMERIC ARRAY. THE COMMAND PROMPTS FOR COLUMN NUMBER WITH "COL=", THEN PROMPTS FOR AN ELEMENT STRING WITH THE DELIMITER CHARACTER. IF ONLY F IS GIVEN, ELEMENTS ARE REPLACED IN ROW F STARTING WITH THE ENTERED COLUMN. IF BOTH F AND T ARE GIVEN, ELEMENTS ARE REPLACED IN THE ENTERED COLUMN STARTING WITH ROW F. IF THE NUMBER OF ELEMENTS ENTERED IS TOO LARGE, AN ERROR MESSAGE IS RETURNED. A VERIFICATION MESSAGE "ROW CHANGED" OR "COLUMN CHANGED" IS RETURNED IF THE COMMAND IS SUCCESSFUL. IF F, T OR THE NUMBER ENTERED IN RESPONSE TO THE PROMPT IS OUT OF RANGE, AN ERROR MESSAGE IS RETURNED.

ΔRN 3 CHANGE ROW 3
COL=4 COMMAND PROMPTS "COL="; USER TYPES "4"
C 5 9 COMMAND PROMPTS "C"; USER TYPES "5 9"
ROW CHANGED COMMAND RETURNS VERIFICATION
 COL 4, ROW 1 NOW = 5
 COL 4, ROW 2 NOW = 9

ΔRN 5 6 CHANGE ROWS 5 AND 6
COL=2 CHANGE COLUMN 2 IN ROWS 5 AND 6
C 7 8 INPUT OF NEW VALUES
COLUMN CHANGED VERIFICATION

6. THE HELP FUNCTION

ΔH , THE LAST COMMAND OF $\Delta EDITOR$, ALONG WITH TWO FAIRLY LARGE DATA VARIABLES, IS CONTAINED IN A SEPARATE GROUP, $G\Delta EH$, AND OCCUPIES ABOUT 10100 BYTES. IF SPACE IS AVAILABLE, IT IS HELPFUL AS AN AID TO THE NEW USER. THE FORM OF THE HELP COMMAND IS:

ΔH 'CMND'

WHERE "CMND" IS ANY OF THE 21 FULL SET $\Delta EDITOR$ FUNCTIONS. FOR EXAMPLE, ΔH 'AG' WILL RETURN A SHORT DESCRIPTION OF THE AG COMMAND, ITS GENERAL SYNTAX AND EXAMPLES.

7. ADDITIONAL INFORMATION

A. $\Delta EDITOR$ DATA OBJECTS

THE DATA ARRAY " $\Delta\Delta$ " IS CREATED BY ΔE . AS PREVIOUSLY NOTED, IT CONTAINS A COPY OF THE APL FUNCTION OR DATA OBJECT TO BE EDITED. FOUR OTHER DATA OBJECTS ARE CREATED:

$\Delta\Delta N$ - THE NAME OF THE APL OBJECT
 $\Delta\Delta T$ - THE TYPE OF OBJECT
 1 = APL FUNCTION
 2 = CHARACTER ARRAY
 3 = NUMERIC MATRIX
 4 = NUMERIC VECTOR
 $\Delta\Delta S$ - INTERNAL SWITCHES USED BY $\Delta EDITOR$
 $\Delta\Delta D$ - THE CURRENT DELIMITER CHARACTER

B. RESTRICTIONS

$\Delta EDITOR$ WILL WORK ON:

APL FUNCTIONS
TWO DIMENSIONAL CHARACTER ARRAYS
TWO DIMENSIONAL NUMERIC ARRAYS
NUMERIC VECTORS

$\Delta EDITOR$ WILL NOT WORK ON:

ARRAYS OF DIMENSION GREATER THAN TWO

$\Delta EDITOR$ WILL WORK ON, BUT NOT PROPERLY RETURN:

CHARACTER VECTORS
SCALARS

C. AG - ADDITIONAL FUNCTIONS

AG OFFERS THE $\Delta EDITOR$ ADVANCED USER ADDITIONAL FUNCTION OVER THAT DESCRIBED IN CHAPTER 3. THE COMPLETE PARAMETER LIST IS SUMMARIZED BELOW.

ΔG F [T] [P] [V]

F ↔ FROM LINE
[T] ↔ TO LINE
[P] ↔ NUMBER OF PHRASE OCCURRENCES TO REPLACE
[V] ↔ ACTION CODE; 0=INTERACTIVE VERIFY
 1=NO VERIFY,LIST
 2=NO VERIFY,NO LIST

D. ARRAY WIDTH EXPANSION MESSAGE

THE MESSAGE WARNING OF IMPENDING ARRAY WIDTH EXPANSION (ΔA , ΔC , ΔG , ΔR , ΔRC) IS SUPPRESSED WHEN BUILDING A NEW CHARACTER ARRAY, THAT IS, WHENEVER THE USER HAS EXECUTED ΔB .

8. PROGRAMMING TIPS

SINCE Δ EDITOR COMMANDS RENUMBER THE WORKAREA WHENEVER LINES ARE DELETED OR ADDED, IT IS ADVISED TO EDIT FROM THE BOTTOM UP. THE ΔF COMMAND IS VERY USEFUL IN FINDING CURRENT LINE NUMBERS.

A FREQUENTLY ENCOUNTERED SITUATION OCCURS WHEN THE USER IS WORKING ON A FUNCTION CALLED "JOE" AND HAVING PROBLEMS:

```

 $\Delta E$  'JOE'
WORK ON "JOE" WITH  $\Delta C$ , ETC.
 $\Delta X$ 
TRY "JOE", FIND NEW BUG

```

AT THIS POINT, A COPY OF "JOE" IS STILL IN $\Delta\Delta$, AVAILABLE TO THE Δ EDITOR FUNCTIONS; CHANGES MAY BE MADE WITHOUT AN INTERVENING ΔE .

THE USER CAN EXTEND THE COMMAND SET BY DEFINING HIS OWN FUNCTIONS AND/OR IMBEDDING EXISTING FUNCTIONS. FOR EXAMPLE, TO CREATE A FUNCTION CALLED " $\Delta LAR F [T]$ " WHICH LISTS BEFORE REPLACING:

```

[0]  $\Delta LAR I$ 
[1]  $\Delta L I$ 
[2]  $\Delta R I$ 

```

APPENDIX

COMMAND SUMMARY

FUNCTION	CMND	PARAM(S)	PROMPT?	USAGE	GROUP
ADD	ΔA	B [N]	YES	A F N	BASIC
BUILD	ΔB	'TEXT'	YES	A F N	PRIMARY
CHANGE	ΔC	F [T]	YES	A F N	BASIC
COPY	ΔCO	F T B	NO	A F N	PRIMARY
CHG WS	ΔCW		YES	F	FULL
DELETE	ΔD	F [T]	NO	A F N	BASIC
DELIM CHG	$\Delta DELIM$	' α '	NO		FULL
DEL PHR	ΔDP	F [T]	YES	A F	FULL
EDIT	ΔE	'TEXT'	NO	A F N	BASIC
FIND	ΔF		YES	A F	PRIMARY
FIND COL	ΔFC		YES	A F	FULL
GRP CHG	ΔG	F [T]	YES	A F N	BASIC
INSERT	ΔI	B N	NO	F N	PRIMARY
LIST	ΔL	F [T S E]	NO	A F N	BASIC
MERGE	ΔME	F T B	YES	A F N	PRIMARY
MOVE	ΔMV	F T B	YES	A F N	PRIMARY
REPLACE	ΔR	F [T]	YES	A F N	PRIMARY
REPL COL	ΔRC	F [T]	YES	A F	FULL
REPL NUM	ΔRN	F [T]	YES	N	FULL
STATUS	ΔS		NO		PRIMARY
WIDTH	ΔW	B N	NO	F N	PRIMARY
EXIT	ΔX		NO	A F N	BASIC

KEY: 'TEXT' \leftrightarrow APPROPRIATE NAME IN QUOTES
' α ' \leftrightarrow ANY SINGLE APL CHARACTER
F \leftrightarrow FROM LOCATION
T \leftrightarrow TO LOCATION
B \leftrightarrow LINE BEFORE WHICH COMMAND OPERATES
N \leftrightarrow NUMBER OF LINES OR COLUMNS
S \leftrightarrow STARTING COLUMN OR ELEMENT
E \leftrightarrow ENDING COLUMN OR ELEMENT
[] \leftrightarrow OPTIONAL PARAMETER

USAGE: A \leftrightarrow USE ON ALPHA ARRAYS
F \leftrightarrow USE ON APL FUNCTIONS
N \leftrightarrow USE ON NUMERIC OBJECTS