Anhang A

Halstead: Detaillierte Übersicht der ABAP/4-Interpretation

Zusammenstellung der ABAP/4-Schlüsselworte und deren Gewichtung als Operator und die entsprechende Anzahl von Operanden

Um korrekte und nachvollziehbare Ergebnisse der Messungen nach Halstead zu erhalten, sind eindeutige Regeln zur Identifizierung von Operatoren und Operanden zwingend.

Neben einer vollständigen Auflistung aller als Operator geltenden ABAP/4-Schlüsselworte, ist ihre Gewichtung als Operator für die Ermittlung der Anzahl der Operatoren entscheidend. Diese fließt in die eindeutige Anzahl von Operatoren η_1 und in die Gesamtzahl N_1 ein. Ebenso ist die Kenntnis der Anzahl der Operanden für das jeweilige Schlüsselwort wichtig. Sie gehen in die Basisgrößen η_2 und N_2 ein.

In der folgenden Übersicht sind alle ABAP/4-Schlüsselworte in der Grundform und in ihren Varianten aufgelistet. Dies gilt für die Anweisungen, die im Reporting ihren Einsatz finden, da in der Diplomarbeit nur Reports und keine Dialogprogramme betrachtet werden.

Hinweise zur Übersicht der ABAP/4-Interpretation:
Die Darstellung der ABAP/4-Schlüsselworte erfolgt in Versalbuchstaben. Variable und Paramter in den Varianten sind in Kleinbuchstaben geschrieben. Besitzt eine Anweisung keine Variante oder kann der Befehl ohne Variante eingesetzt werden, ist dies mit einem "◇" gekennzeichnet. Die Anzahl der Operatoren ist als Summe angegeben, z.B. für "`APPEND tab SORTED BY f.`": 2+(1). Der erste Summand zeigt die Gewichtung der Anweisung als Operator an. Der zweite Summand bezieht sich auf die entsprechenden Metazeichen "`.`" oder "`,`" zu dem Schlüsselwort. Insgesamt besteht das obige Beispiel aus 3 Operatoren. Setzt sich eine ABAP/4-Anweisung in ihrer Variante aus n Teilanweisungen zusammen, ist die Anzahl der Operatoren mit z.B. $1+2\cdot n+(1)$ beziffert, siehe ABAP/4-Schlüsselwort "`CALL`". Optionale Vari-

anten, z.B. bei “WRITE”, werden zur jeweiligen Anzahl addiert: +1. Die Anzahl der Operanden erfolgt direkt als Zahl oder auch als Summe. Die Angabe als Summe geschieht, wenn die Befehlsvariante n Operanden umfaßt, z.B. bei “CALL”.

Grundform des Befehls	Varianten	Anzahl	
		Operator	Operand
ADD	f_1 TO f_2	1+(1)	2
	f_1 THEN f_1 UNTIL f_3 GIVING f_4	2+(1)	4
	f_1 THEN f_2 UNTIL f_3 TO f_4	2+(1)	4
	f_1 THEN f_2 UNTIL f_3 ACCORDING TO f_4 GIVING f5	3+(1)	5
	f_1 FROM i TO j GIVING f_2	2+(1)	4
ADD-CONDITIONAL	f_1 TO f_2	1+(1)	2
ADD-CORRESPONDING	k TO l	1+(1)	2
ADD-SELECTIVE	f_1 TO f_2	1+(1)	2
APPEND	tab	1+(1)	1
	tab SORTED BY f	2+(1)	2
ASSIGN	f TO <fs>	1+(1)	2
	LOCAL COPY OF f TO <fs>	2+(1)	2
	f TO <fs> TYPE t	2+(1)	3
	f TO <fs> DECIMALS d	2+(1)	3
	f+off(len) TO <fs>	3+(1)	4
	<fs$_1$>+off(len) TO <fs$_2$>	3+(1)	4
	(f) TO <fs>	1+(1)	2
	COMPONENT n OF STRUCTURE f_1 TO <f>	2+(1)	3
AT ... ENDAT	NEW f	1+(2)	1
	END OF f	1+(2)	1
	FIRST	1+(2)	0
	LAST	1+(2)	0
	fg	1+(2)	1
	fg_1 WITH fg_2	2+(2)	2
AT	LINE-SELECTION	1+(1)	0
	Pfxx	1+(1)	1
	USER-COMMAND	1+(1)	0
	SELECTION-SCREEN	1+(1)	0
	SELECTION-SCREEN ON p	1+(1)	1
	SELECTION-SCREEN ON END OF p	1+(1)	1
	SELECTION-SCREEN OUTPUT	1+(1)	0
BACK	◇	1+(1)	0
CALL	p ID id_1 FIELD f_1 ... ID id_n FIELD f_n	1+2·n+(1)	1+2·n
	p MODUL m COMPONENT c ID id_1 FIELD f_1 ...	3+2·n+(1)	3+2·n
	MENU m	1+(1)	1
	TRANSACTION '...' USING t MODE m	3+(1)	3
	SCREEN nnnn	1+(1)	1
	SCREEN nnnn STARTING AT x_1 y_1 ENDING x_2 y_2	2+(1)	5
	DIALOG d EXPORTING f_1 .. f_n IMPORTING t_1 ... t_m	3+(1)	1+n+m
	FUNCTION f EXPORTING f_1 ... f_n	2+(1)	1+2·n
	IMPORTING t_1 ... t_m	+1	+2·m
	TABLES tab_1 ... tab_o	+1	+2·o
	EXCEPTIONS r_1 ... r_p	+1	+2·p
CASE ... WHEN ... ENDCASE	f. WHEN w_1 ... WHEN OTHERS ...	1+(2+n)	1+n
CHECK	SELECT-OPTIONS	2+(1)	0
	s_1	1+(1)	1
	t_1 op f_2 AND ... AND t_n op f_n	1+2·n+(1)	2·n
CLEAR	f	1+(1)	1
CLOSE	DATASET dsn	1+(1)	1
CNT	(f)	1+(1)	1
COLLECT	itab	1+(1)	1

Grundform des Befehls	Varianten	Anzahl	
		Operator	Operand
COMMIT WORK	◇	1+(1)	0
COMPUTE	<ausdruck>	1+(1)	0
CONDENSE	f	1+(1)	1
	f NO-GAPS	2+(1)	1
CONVERT	form$_1$ f$_1$ TO form$_2$ f$_2$	1+(1)	4
CURRENCY-	b$_1$ w$_1$ TO b$_2$ w$_2$	1+(1)	4
CONVERSION	b$_1$ w$_1$ TO b$_2$ w$_2$ DATE d	2+(1)	5
	b$_1$ w$_1$ TO b$_2$ w$_2$ TABLE t	2+(1)	5
	b$_1$ w$_1$ TO b$_2$ w$_2$ RATE k	2+(1)	5
	b$_1$ w$_1$ FROM b$_2$ w$_2$	1+(1)	4
DEFINE ...	m	1+(1)	1
END-OF-DEFINITION			
DELETE	tab	1+(1)	1
	t	1+(1)	1
	t INDEX i	2+(1)	2
	FROM tab WHERE <c>	2+c+(1)	2+c
	DOCUMATION key LANGUAGE l	2+(1)	2
	REPORT f$_1$	1+(1)	1
	TEXTPOOL f$_1$ LANGUAGE l	2+(1)	2
	TEXT NUMBER n LANGUAGE l TEXT-ID i	3+(1)	3
	FROM DATABASE dna(ar) ID f	3+(1)	3
	MATCHCODE FOR OBJECT o USING t$_1$ ... t$_n$	2+(1)	1+n
DEQUEUE	ID i FIELD f	1+(1)	2
DESCRIBE	FIELD f$_1$ LENGTH f$_2$	2+(1)	2
	FIELD f$_1$ TYPE f$_2$	2+(1)	2
	FIELD f$_1$ OUTPUT-LENGTH f$_2$	2+(1)	2
	FIELD f$_1$ DECIMALS f$_2$	2+(1)	2
	FIELD f$_1$ EDIT MASK f$_2$	2+(1)	2
	TABLE t OCCURS o	2+(1)	2
	TABLE t MAX-LINES l	2+(1)	2
	TABLE t NAME n	2+(1)	2
	DISTANCE BETWEEN f$_1$ AND f$_2$ INTO d	2+(1)	3
DETAIL	◇	1+(1)	0
DIVIDE	f$_1$ BY f$_2$	1+(1)	2
DIVIDE-	k BY l	1+(1)	2
CORRESPONDING			
DO ... ENDDO	◇	1+(2)	0
	f TIMES	2+(2)	1
	f TIMES VARYING x FROM f$_1$ NEXT f$_2$	3+(2)	4
EDITOR-CALL	FOR t	1+(1)	1
	FOR t TITLE text	2+(1)	1
	FOR t DISPLAY-MODE	2+(1)	1
	FOR DOCUMENTATION t	1+(1)	1
	FOR REPORT r	1+(1)	1
	FOR TEXT t	1+(1)	1
END-OF-PAGE.	◇	1+(1)	0
END-OF-SELECTION.	◇	1+(1)	0
ENQUEUE	ID i FIELD f	1+(1)	2
EXEC ... ENDEXEC	SQL	1+(2)	0
EXIT	◇	1+(1)	0
	FROM STEP-LOOP	2+(1)	0
	FROM SQL	2+(1)	0
	FROM SIMULATION	2+(1)	0
EXPORT	f t TO DATABASE dns(ar) ID k	3+(1)	5
	f t TO MEMORY	1+(1)	2
	f t TO MEMORY ID k	2+(1)	3
EXTRACT	g	1+(1)	1
FILL	l	1+(1)	1
	l FROM sg	2+(1)	2
FOR ... ENDFOR	ALL sg	1+(2)	1

Grundform des Befehls	Varianten	Anzahl Operator	Anzahl Operand
	ALL sg WERE key FROM MATCHCODE m	3+(2)	3
FORM ... ENDFORM	r	1+(2)	1
	r USING p_1 ... p_n	2+(2)	n
	r USING p_1 VALUE(p_2) ...	3+(2)	n
	r USING VALUE(p_1) ... CHANGING VALUE (p_n)	1+n+(2)	n
	r USING TABLES tab_1 ... tab_n	3+(2)	n
	r USING STRUCTURE t_1 ... t_n	3+(2)	n
FORMAT	RESET	1+(1)	0
	INTENSIFIED ON/OFF	1+(1)	0
	INPUT	1+(1)	0
	UNDERSCORED	1+(1)	0
	BLINKING	1+(1)	0
	INVERSE	1+(1)	0
	COLOR c	1+(1)	1
FREE	t	1+(1)	1
	tab	1+(1)	1
	MEMORY	1+(1)	0
	MEMORY ID i	2+(1)	1
GET	sg	1+(1)	1
	sg LATE	1+(1)	1
	PARAMETER ID '...' FIELD f	2+(1)	1
	CURSOR FIELD f	1+(1)	1
	TIME	1+(1)	0
	TIME FIELD f	2+(1)	1
	RUN TIME FIELD f	1+(1)	1
HIDE	f_1	1+(1)	
IF ... ELSEIF ... ELSE ... ENDIF	f_1 op f_2 ... ELSE ...	2+(3)	2
	t_1 op f_1 AND ... AND t_n op f_n ELSE ...	4+3n	2·n
	f_1 BETWEEN f_2 AND f_3 ... ELSE ...	3+(3)	3
	f_1 IS INTIAL ... ELSE ...	2+(3)	1
	f_1 IN s_1 ... ELSE ...	2+(3)	2
	f_1 op f_2 ... ELSEIF f_3 op f_4 ... ELSE ...	4+(4)	4
IMPORT	f t FROM DATABASE dns(ar) ID k	3+(1)	5
	f t FROM MEMORY	1+(1)	2
	f t FROM MEMORY ID k	2+(1)	3
	f t FROM LOGFILE ID k	2+(1)	3
INITIALIZATION	◇	1+(1)	0
INPUT		1+(1)	
INSERT	INTO tab VALUES wa	2+(1)	2
	tab	1+(1)	1
	tab INDEX i	2+(1)	2
	f g h INTO fg	2+(1)	4
	REPORT rep FROM tab	2+(1)	2
	TEXTPOOL rep FROM tab LANGUAGE l	3+(1)	3
	TEXT NUMBER n LANGUAGE l TEXT-ID i FROM t	4+(1)	4
	MATCHCODE FOR OBJECT o USING t_1 ... t_n	2+(1)	1+n
LEAVE	TO TRANSACTION t	2+(1)	1
	TO MENU 'xxx'	2+(1)	2
	TO LIST-PROCESSING	2+(1)	0
	TO LIST-PROCESSING AND RETURN TO SCREEN n	3+(1)	1
	SCREEN	2+(1)	0
	◇	1+(1)	0
LOCAL	f	1+(1)	1
LOOP ... ENDLOOP	AT itab	2+(2)	1
	AT itab FROM g TO h	3+(2)	3
	AT itab WHERE cond	3+c+(2)	1+c
	AT tab	2+(1)	1

Grundform des Befehls	Varianten	Anzahl	
		Operator	Operand
	◇	1+(1)	0
	AT SCREEN	2+(2)	0
MARK		1+(1)	0
MESSAGE	Innn	1+(1)	1
	Wnnn	1+(1)	1
	Ennn	1+(1)	1
	Annn	1+(1)	1
	Snnn	1+(1)	1
	Innn WITH f_1 f_2 f_3 f_4	2+(1)	5
	Innn RAISING excep	2+(1)	2
	ID p_1 TYPE p_2 NUMBER p3 WITH ...	2+(1)	3
MODIFY	tab	1+(1)	1
	itab	1+(1)	1
	itab INDEX i	2+(1)	2
	LINE n	1+(1)	1
	LINE n OF CURRENT PAGE	2+(1)	1
	LINE n OF PAGE n	2+(1)	2
	CURRENT LINE	1+(1)	0
	LINE n FIELD VALUE f_1 FROM g_1 ... f_n FROM g_n	1+n+(1)	1+2·n
	WINDOW LINE n	1+(1)	1
	SCREEN	1+(1)	0
MODULE ... ENDMODULE	m	1+(2)	1
	m OUTPUT	2+(2)	1
	m INPUT	2+(2)	1
MOVE	f TO g	1+(1)	2
	f TO g PERCENTAGE p	2+(1)	3
	f TO g PERCENTAGE p RIGHT	3+(1)	3
MOVE-CONDITIONAL	f TO l	1+(1)	2
MOVE-CORRESPONDING	k TO l	1+(1)	2
MOVE-DYNPRO	NUMBER n TO t	1+(1)	2
	Dxxnnn TO t	1+(1)	2
MOVE-TEXT	x TO t	1+(1)	2
	NUMBER n LANGUAGE l TEXT-ID i TO t	4+(1)	4
MULTIPLY	f_1 BY f_2	1+(1)	2
MULTIPLY-CORRESPONDING	k BY l	1+(1)	2
NEW-LINE		1+(1)	0
NEW-PAGE	◇	1+(1)	0
	NO-TITLE	2+(1)	0
	WITH TITLE	2+(1)	0
	NO-HEADING	2+(1)	0
	WITH HEADING	2+(1)	1
	APPEND tab	2+(1)	1
	PRINT OFF	2+(1)	0
	NEW-SECTION	2+(1)	0
	PRINT ON ...	2+1+(1)	...
ON ... ENDON	CHANGE OF f_1 OR ... OR f_n	1+n+(2)	n
OPEN	DATASET dsn	1+(1)	1
QUEUE	q	1+(1)	1
OVERLAY	f WITH g	1+(1)	2
	f WITH g ONLY c	2+(1)	3
PACK	f TO g	1+(1)	2
PERFORM	r	1+(1)	1
	r(nnnnnnnn)	2+(1)	2
	r IN PROGRAMM nnnnnnnn	2+(1)	2
	r(Vnnnnnnnn) IN UPDATE TASK LOGGING f_1 ... f_n	2+(1)	2+n
	r(Vnnnnnnnn) IN RESTART TASK		

Grundform des Befehls	Varianten	Anzahl Operator	Anzahl Operand
	LOGGING f_1 ... f_n	2+(1)	2+n
	r USING p_1 ... p_n	2+(1)	1+n
	r OF UP1 UP2 ...	1+(1)	1+n
	r TABLES tab_1 ... tab_n USING p_1 ... p_m	3+(1)	1+n+m
POSITION	p	1+(1)	1
PROVIDE ... ENDPROVIDE	$f_1 1$ ... f_{1n} FROM t_1 ... f_{n1} ... f_{nn} FROM t_n	n+(2)	n+feld
	BETWEEN d_1 AND d2	1+(2)	2
PUT	t	1+(1)	1
RANGES	r FOR f	1+(1)	2
READ	TABLE Tn	1+(1)	1
	TABLE INDEX i	2+(1)	1
	TABLE COMPARING f_1, ...f_n	2+(1)	n
	TABLE COMPARING ALL FIELDS	2+(1)	1
	TABLES TRANSPORTING f_1, ... f_n	2+(1)	n
	TABLES TRANSPORTING NO FIELDS	2+(1)	1
	TABLE SEARCH k	2+(1)	0
	TABLE SEARCH WITH KEY k BINARY SEARCH	2+(1)	1
	SEGMENT s	1+(1)	1
	CALENDAR c WITH DATE d DAY-AFTER	3+(1)	2
	LINE i OF CURRENT PAGE	2+(1)	1
	LINE i OF PAGE p	2+(1)	2
	CURRENT LINE	1+(1)	0
	WINDOW LINE i	1+(1)	1
	DOCUMENTATION k LANGUAGE sp INTO tab	3+(1)	3
	REPORT name INTO tab	2+(1)	2
	TEXTPOOL name INTO tab LANGUAGE sp	3+(1)	3
	DYNPRO-TEXT name INTO tab LANGUAGE sp	3+(1)	3
	DATASET dsn INTO tab LENGTH l	3+(1)	3
	TEXT NUMBER n LANGUAGE sp TEXT-ID id INTO t	4+(1)	4
REFRESH	t	1+(1)	1
	t FROM TABLE tab	2+(1)	2
	t FROM SELECT-OPTIONS	2+(1)	1
	t FROM SELECT-OPTIONS OF MAIN PROGRAM	2+(1)	1
	DYNPRO Dxxnnn	1+(1)	1
REJECT	◇	1+(1)	0
	f	1+(1)	1
REPLACE	f WITH g INTO h	1+(1)	3
	f LENGTH l WITH g INTO h	2+(1)	4
RESERVE	f LINES	1+(1)	2
RESTORE	FROM tab	1+(1)	2
SEARCH	t FOR s	1+(1)	2
	t FOR s ABBREVIATED	2+(1)	2
	t FOR s STARTING AT l1 ENDINF AT l2	2+(1)	4
	t FOR s AND MARK	2+(1)	2
SECURITY	f	1+(1)	1
SELECT ... ENDSELECT	f_1 ... f_n FROM tab	1+(2)	n+1
	* FROM tab	1+(2)	2
	* FROM tab WHERE $cond_1$ AND ... $cond_n$	3+(2)	2+2+n
	* FROM tab WHERE f BETWEEN f_1 AND f_2	3+(2)	5
	* FROM tab WHERE f IN (f_1, ... f_n)	2+(2)	3+n
	* FROM tab WHERE f LIKE var	2+(2)	4
	* FROM tab WHERE f IN itab	2+(2)	4
	* FROM tab ORDER BY f_1 ... f_n	2+(2)	2+n
	* FROM tab ORDER BY PRIMARY KEY	2+(2)	3

Grundform des Befehls	Varianten	Anzahl Operator	Anzahl Operand
SELECT	SINGLE * FROM tab WHERE $cond_1$ ...	2+(1)	2+n
	SINGLE FOR UPDATE * FROM tab WHERE $cond_1$ ...	3+(1)	2+2·n
SET	PF-STATUS '...'	1+(1)	1
	SCREEN n	1+(1)	1
	CURSOR c l	1+(1)	2
	CURSOR FIELD f LINE l OFFSET o	4+(1)	3
	PARAMETER ID '...' FIELD f	2+(1)	2
	LANGUAGE l	1+(1)	1
	COUNTRY c	1+(1)	1
	BLANK LINES ON/OFF	1+(1)	0
	MARGIN x y	1+(1)	2
	TRACE ON/OFF	1+(1)	0
	FLOW TRACE ON/OFF	2+(1)	0
	DATABSE TRACE ON/OFF	2+(1)	0
	EXTRACT TRACE ON/OFF	2+(1)	0
	WORKFILE TRACE ON/OFF	2+(1)	0
	TRANSFER TRACE ON/OFF	2+(1)	0
	INTERRUPT	1+(1)	0
	RUN TIME ANALYZER ON/OFF	1+(1)	0
	RESTART AREA f	1+(1)	1
SHIFT	f	1+(1)	1
	f BY x PLACES	2+(1)	2
	f CIRCULAR	2+(1)	1
	f RIGHT	2+(1)	1
	f UP TO g	2+(1)	2
SKIP	◇	1+(1)	0
	n	1+(1)	1
	TO LINE f	2+(1)	1
SORT	◇	1+(1)	0
	t	1+(1)	1
	t DESCENDING	2+(1)	1
	t ASCENDING	2+(1)	1
	t BY $f_1 ... f_n$	2+(1)	1+n
	BY fg	2+(1)	1
START-OF-SELECTION.	◇	1+(1)	0
STOP	◇	1+(1)	0
SUBTRACT	f_1 FROM f_2	1+(1)	2
SUBTRACT-CORRESPONDING	k FROM l	1+(1)	2
SUM	◇	1+(1)	0
SUMMARY	◇	1+(1)	0
SUMMING	f	1+(1)	1
SUPPRESS	DIALOG	1+(1)	0
SYSTEM-CALL	FREE MODE m	1+(1)	1
	RESUME MODE m	1+(1)	1
	NEW MODE t	1+(1)	1
	NEXT MODE	1+(1)	0
	PREVIOUS MODE	1+(1)	0
	HELP	1+(1)	0
TEXTS	xxx	1+(1)	1
TOP-OF-PAGE.	◇	1+(1)	0
TRANSFER	f TO dsn	1+(1)	2
	sg TO dsn	1+(1)	2
	f TO dsn RECEIVING LABEL g	2+(1)	3
	f TO QUEUE q	1+(1)	2
TRANSFER-DYNPRO	Dxxnnn	1+(1)	1
	Dxxnnn GENERATING A TRAINING SESSION	2+(1)	1
	Dxxnnn GENERATING ONLINE		

Grundform des Befehls	Varianten	Anzahl	
		Operator	Operand
	COMMUNICATION	2+(1)	1
TRANSLATE	f TO UPPER CASE	1+(1)	1
	f TO LOWER CASE	1+(1)	1
	f USING g	1+(1)	1
	f FROM CODE PAGE g$_1$ TO CODE PAGE p$_2$	1+(1)	3
ULINE	◇	1+(1)	0
	p(n)	2+(1)	1
	/p(n)	3+(1)	1
UNPACK	f TO g	1+(1)	2
UPLOAD ...	r	1+(2)	1
ENDUPLOAD	r FORM FILE n	2+(2)	2
WHILE ... ENDWHILE	f$_1$ op f$_2$	1+(2)	2
	f$_1$ op f$_2$ VARY x FROM g$_1$ NEXT g$_2$	2+(2)	5
WINDOW	STARTING AT x$_1$ y$_1$ ENDING AT x$_2$ y$_2$	1+(1)	4
	WITH FRAME	+1	+0
	TITLE t	+1	+1
WRITE (Standard)	<variable>	1+(1)	1
WRITE (Formatangabe)	/	+1	+0
	s	+1	+1
	(l)	+1	+1
	'...'(l)	+1	+2
WRITE (Aufbereitung)	No-Zero	+1	+0
	No-Sign	+1	+0
	DD/MM/YY	+1	+0
	Currency	+1	+0
	Currency Local	+1	+0
	Decimals	+1	+1
	Round	+1	+1
	Exponent	+1	+1
	Under	+1	+1
	Using Edit Mask '...'	+1	+1
	Using No Edit Mask	+1	+0
WRITE	für jeweiliges Format:	+1	+1
(Aufgabeformate)	f TO g+o(l) INDEX i	4	4
	(f) TO g+o(l) INDEX i	5	4