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SUBJECT: WHIRLWIND I ALARMS

To: S&EC Group, Group 61 and Systems Group

From: Joseph W. Thompson

Date: January 15, 1954

Abstract: The possible causes of WWI alarms due to programming errors and the interpretation of the final contents of pertinent registers are presented in this memorandum.

Introduction

Six types of alarms are generated by the improper use of the WWI instruction code. The alarms described in this memorandum are the arithmetic check, divide, check register, program, parity and inactivity alarms. The attached table (SB-57592) shows how the improper use of the WWI instruction code will produce an arithmetic check, divide error, or check register alarm. This table should be of assistance to the programmer in determining the cause of the alarm and to the computer operator in recording significant register contents at the time of the alarm.

Emphasis has been placed on the Arithmetic Check Alarm (overflow) because any one of nine WWI instructions used improperly will result in this alarm. Each of the other alarms can be caused by the improper use of only one instruction.

Program Alarm

Should the Ferranti reader or Magnetic Tape be selected with too much delay between the si and rd instructions, a program alarm results because the IOR is not cleared and information is read from the Ferranti or Magnetic Tape over the information already in the IOR.

In order to de-select the Magnetic Tape a 400 (o) is added to the IOS if the Computer is stopped while the Magnetic Tape is being used.

If the Computer is stopped while the Ferranti is in use, 400 (o) is not added to the IOS. Therefore, the Ferranti is not de-selected and if the tape is pulled forward manually a program alarm will be generated.

Inactivity Alarm

The inactivity alarm indicates that the computer has waited too long (500 ms) for the completion of an operation. This alarm generally occurs when an illogical sequence of in-out instructions is given or when the in-out equipment is unable to respond. The inactivity alarm is suppressed for four types of in-out equipment: Magnetic Tape, Flexowriter, Camera and Ferranti. Usually the cause of an inactivity alarm may be determined by

examining the In-Out Switch and the Control Switch. In most cases an inactivity alarm results from a programming error, for example, using an "rc" or "bo" instruction with an "si 703". (si 700 - si 703 selects a drum group for a "rd" instruction.) The first "rc" or "bo" instructions are ignored and the alarm will occur during performance of the second "rc" or "bo" instruction.

Parity Alarm

A parity alarm usually indicates a computer malfunction but may also occur as a result of an attempt to "bi" or "rd" from an illegal drum group.

Loop

A loop could be termed a non-terminating cycle of instructions. The presence of a loop is generally identified by an accompanying recurrent series of tones in the audio.

Check Register Alarm

In addition to the information on the attached table, programmers and operators should note that a check register alarm occurring during read-in with the PC equal to 104 is an indication that an error in the tape has been uncovered by the sum check. If the same results occur on a second read-in, the tape should be returned to the tape room for correction or re-conversion.

General

On any type of alarm the vertical decoders hold the C(AC) on the last si instruction and the horizontal decoders hold the C(AC) on the last rc instruction.

On any type of alarm FF#2 contains sp y and FF#3 contains sp 1 unless the FFs are used by the program. y refers to the starting address of the last 556 tape read in.

With one exception the In-Out Switch holds the last si instruction executed: when the computer is stopped while the Magnetic Tape is being used, a 400(o) is added to the In-Out Switch in order to de-select the unit.

Drawing SB 57592

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Definitions for SA 57592

x = address of a storage register. $0 \leq x \leq 2047$

y = starting address of 556 tape

C( ) = original contents of register ( ).

F{ } = fractional part of the quantity in { } .

n = positive integer (taken mod 32) $0 \leq n \leq 2047$.

ρ = round off from BR. If C(BR0) = 1, $\rho = 2^{-15}$. If C(BR0) = 0, $\rho = 0$.

AC+BR = the composite 32 digit register (including sign) composed of the AC and BR taken in that order.

In operations dv, srr0, slrn, the sign of the C(BR) is assumed to be the same as the sign of the C(AC); in the operation ab, C(BR) is assumed to have its own sign.

PC = program counter

PAR = parity auxiliary register (will serve same purpose as a program register at the proper times)

BR = B- register

AR = A- register

CR = check register

CS = control switch

IOS = in-out switch

GSR = group selector register

SAR = storage address register

IOR = in-out register

SAM = special add memory

TPD = time pulse distributor

FF = flip-flop

SB-575 p2

ARITHMETIC CHECK (OVERFLOW)

INSTRUCTION	ADX	SUX	CAX	CSX	CAX	AOX	ABX	SLRN	SRR 0	DIVIDE DVX	CHECK REGISTER CKA
POSSIBLE CAUSE	$\|C(AC)+C(x)\| \geq 1$	$\|C(AC)-C(x)\| \geq 1$	$\|C(x)+C(SAM)2^{-15}\|=1$	$\|-C(x)+C(SAM)2^{-15}\|=1$	$\|C(x)\|+C(SAM)2^{-15}=1$	$C(x)+(1x2^{-15})=1$	$\|C(BR)+C(x)\| \geq 1$	$\|N\{C(AC+BR)2^{N}\}+\rho\|=1$	C(AC)=0.77777 BR(0)=1	$\|C(AC)\| > \|C(x)\|$	C(AC)≠C(x)
CONTENTS	To get original contents of AC: If C(AR)>0, subtract C(AR) from C(AC). If C(AR)<0, make AC(0)=0 and subtract $1x2^{-15}$ from AC15. Then subtract C(AR) from modified C(AC). [(AC considered numerical (also true for su instr.)]	To get original contents of AC; If C(AR)>0, make AC(0)=0 and subtract $1x2^{-15}$ from AC15. Complement C(AR) and subtract from modified C(AC). If C(AR)<0, complement C(AR) and subtract from C(AC).	Alarm occurs if: C(x)=0.77777 and C(SAM)=$1x2^{-15}$ or C(x)=1.00000 and C(SAM)=$-1x2^{-15}$ SAM is cleared on alarm.	Alarm occurs if: C(x)=1.00000 and C(SAM)=$1x2^{-15}$ or C(x)=0.77777 and C(SAM)=$-1x2^{-15}$ SAM is cleared on alarm.	Alarm occurs if: C(x)=1.00000 or 0.77777 and C(SAM)=$1x2^{-15}$ SAM is cleared on alarm.	Alarm occurs if: C(x)=0.77777	Since the C(BR) and the C(x) are unaffected. the two numbers causing the alarm may be detected.	Alarm occurs if: C(AC)=0.77777 and C(BRO)=1 after shift but before round-off.	Only a srr 0 can cause an alarm provided C(AC)=0.77777 and C(BRO)=1. Srr 0 does not shift, but rounds off.	To get original contents of AC: Add C(AC carry) + C(AC partial) + C(AR), divide by 2, and add C(AR). If C(PAR) is positive and C (sign control FF) is negative complement results.	illegal instructions (00110 and 00001) of the instr. code will give a check alarm. +0≠-0
PC	← address of next instruction to be executed →										
PR (PAR)	← next instruction to be executed →									C(x)	C(x)
BR	unaffected	unaffected	cleared	cleared	cleared	unaffected	unaffected	cleared	cleared	sil if BR was cleared previously	unaffected
AC CARRY	← cleared →									carry before alarm	cleared
AC PARTIAL	C(AC)+C(x)+ any high speed carry	C(AC)-C(x)+ any high speed carry	1.00000 or 0.77777	0.77777 or 1.00000	1.00000	1.00000	C(BR)+C(x)+ any high speed carry	1.00000	1.00000	unpredictable	unaffected
AR	C(x)	C(x)	C(x)	C(x)	|C(x)|	C(x)	C(x)	unaffected	unaffected	|c(x)|	unaffected
CR	← same as PAR →									same as PC	logical difference
CS	← cleared →									dV	ck
ICS	← last si executed (4CO(0) is added if the computer is stopped while A.T. is in use) →										
CSR	← last drum group used →										
SAR	← last register used +$1X2^{-15}$ →										
ICR	← last information read off IOE or cleared if a rd instruction occurred before alarm →										
X	unaffected	unaffected	unaffected	unaffected	unaffected	1.00000	C(BR)+C(x)+ any high speed carry	unaffected	unaffected	unaffected	unaffected
FF2	← spy unless used by program →										
FF3	← spl unless used by program →										
TPD	← 4 →									2	1
VERTICAL DECODERS	← C(AC) on last si instruction →										
HORIZ. DECODERS	← C(AC) on last rc instruction →										
SIGN CONTROL FF	← cleared →									sign of prospective quotient	cleared

FINAL CONTENTS OF PERTINENT REGISTERS