IBM

650 PROGRAM SHEET

PROBLEM: _____ WRITTEN BY: _____

INSTR NO.	LOCATION OF INSTRUCTION	INSTRUCTION OP	INSTRUCTION DATA	INSTRUCTION INSTRUCTION	OPERATION ABBRV.	IAS RING	REMARKS
2	0001	60	0701	0002	RAU		ADD # in 0701 to upper
3	0002	10	0702	0003	AUP		add # in 0702 to "
4	0003	10	0703	0004	AUP		" " " 0703 " "
5	0004	10	0704	0005	AUP		" " " 0704 " "
6	0005	19	0705	0006	MPY		Product takes all of accum
7	0006	64	0706	0007	DVR		Quotient is in lower
8	0007	60	8002	0008	RAU		8002 is adress of lower.
9	0008	10	8003	0009	AUP		"Add to upper what is in upper"
10	0009	19	8003	0010	MPY		MULT " " Product takes all of accum
11	0010	64	0707	0011	DVR		Divide / Quotient in lower
12	0011	20	0727	0012	STL		store the lower in 0727
13	0012	71	0727	0013	PCH		Punch a card of # 0727
14	0013	01	0000	0000	HLT		STOP
1	0000	70	1701	0001	RCD		Read the card, this starts Mach

WATSON SCIENTIFIC COMPUTING LABORATORY
School Visit Program

A Group	B Group	C Group	D Group
9:30-10:30 "Introduction to Computing 2nd Floor Class	9:30-10:30 Same 2nd Fl. Classroom	9:30-10:30 Same	9:30-10:30 Same
10:30-10:45 Demonstration 1st Fl. Machine	10:30-10:45 Morning Break	10:30-10:45 Demonstration Basement Mach.	10:30-10:45 Morning Break
10:45-11:00 Morning Break	10:45-11:00 Demonstration 1st Fl. Machine	10:45-11:00 Morning Break	10:45-11:00 Demonstration Basement Machine
11:00-12:00 "Using the IBM 650" 2nd Fl. Class	11:00-12:00 Same 2nd Fl. Classroom	11:00-12:00 Same	11:00-12:00 Same
12:00-1:00 LUNCH	12:00-1:00 LUNCH	12:00-1:00 LUNCH	12:00-1:00 LUNCH
1:00-1:15 "Preparation of Research Problem 2nd Fl Class	1:00-1:15 Same 2nd Fl. Classroom	1:00-1:15 Same	1:00-1:15 Same
1:15-1:45 Keypunching 1st Floor	1:15-1:45 Same as A 1st Fl. Machine	1:15-1:45 Keypunching Basement	1:15-1:45 Same as C Basement
1:45-2:15 Sorting 1st Floor	1:45-2:15 Same as A	1:45-2:15 Sorting Basement	1:45-2:15 Same as C Basement
2:15-2:30 650 Computing 1st Floor	2:15-2:30 Same as A	2:15-2:30 650 Computing Basement	2:15-2:30 Same as C
2:30-3:00 Results Discussed 2nd Floor	2:30-3:00 Results Discussed 2nd Fl. Classroom	2:30-3:00 Same	2:30-3:00 Same

A Simplified System

FOR THE USE OF AN
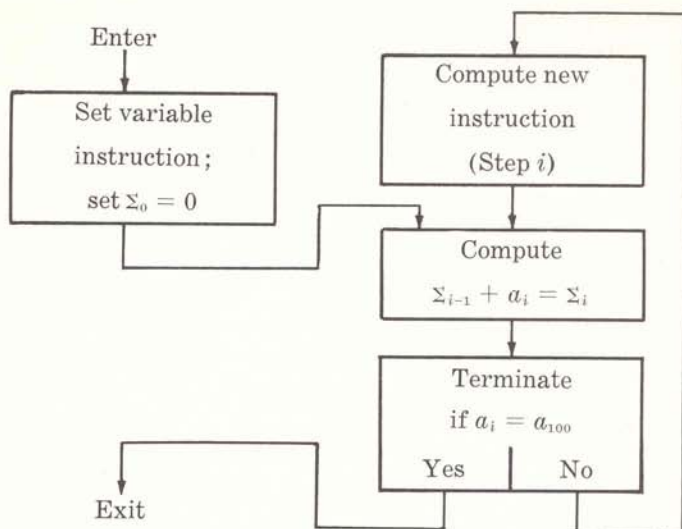
Automatic Calculator

I. Introduction

1. THE SYSTEM

One of the most exciting achievements of our generation is the development of the electronic automatic digital calculator. Although any schoolboy can perform any operation done by the calculator, the speed and economy with which the calculator does them are so great that automatic calculation is revolutionizing large areas of science, engineering, business, industry, and defense. A single giant calculator can do more arithmetic than the entire population of the United States could do with pencil and paper.*

The calculator described here (the IBM 650) is one of medium speed, i.e. it will perform in two or three minutes calculations that would require a week on a desk calculator. A very important feature of the calculator is the fact that simple written instructions control its operation. This pamphlet in conjunction with several lectures aims to train the novice to write these instructions for the machine solution of moderately complex problems.

In order that the machine be used effectively on the solution of such problems by a large number of people, simple uniform procedures should be followed. This uniformity will help the novice avoid many of the common time-consuming errors made by beginners and will enable the professional computing staff to render effective assistance when needed. It will also permit standardized sets of instructions previously prepared for other purposes to be incorporated in a new problem. This pamphlet therefore describes not only the machine but a "System" for its use. The beginner is requested to follow this System until he has successfully completed several problems. During this initial period he should concentrate on understanding this System rather than dis-

*Eckert, W. J. and Jones, R., *Faster, Faster*, McGraw-Hill, New York, 1955, Introduction.

Enter

Set variable
instruction;
set $\Sigma_0 = 0$

Compute new
instruction
(Step i)

Compute
$\Sigma_{i-1} + a_i = \Sigma_i$

Terminate
if $a_i = a_{100}$

Yes   No

Exit

We must add the following instructions:

0509	RAU	60	0602	0510	Set variable
0510	STU	21	0501	0511	instruction
0511	RAU	60	0603	0512	
0512	STU	21	1500	0500	Set $\Sigma_0 = 0$
0602		10	1201	0502	
0603		00	0000	0000	Constants

At the beginning of the program we transfer the initial value of the variable instruction, which we have stored in 0602 as a program constant, into 0501 with RAU and STU instructions (0509 and 0510). Next we transfer zeros, which have been stored in 0603, into 1500, the summation cell. Now that we are ready to begin the accumulation, we go to the instruction in 0500. The final flow chart and a complete listing of the instructions for the accumulation problem are given below. In the flow chart we speak of the level on the left as the "open" level because it is not a loop, or the "problem" level because it is executed once per problem. Note that the number above the left-hand corner of a box in the flow chart indicates the location of the first of the group of instructions corresponding to that box.

Accumulation example: $S = \Sigma_{i=1}^{100} a_i$
a_1 in 1201, a_2 in 1202, ..., a_{100} in 1300; S in 1500

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