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TELEPHONE
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545 Technology Square
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Dear Ted:

The Multics project is supporting the proposed revised ASCII character set as the Multics character set. However, no representation of the various ASCII characters as patterns of holes in punched cards has been adopted by ASA. Furthermore, it seems almost certain that ASA X3 will not arrive at a single, stable proposal for punched card representation of ASCII before the second quarter of 1967. As a result, it seems very probable that the Multics project will decide on a punched card representation of ASCII before X3 achieves a concensus.

Since the choice of a card code is relevant to design of the Multics I/O system, I have recently contemplated the various possibilities, and I wish to summarize for you the results of my contemplation. The two basic alternatives are:

1) Choose a card code now, or

2) Wait.

If we choose a card code now, then we are confronted by the question of which card code. If we wait, how long should we wait? I will outline the prospects as I see them for both alternatives.

If we try to decide on a card code now, we can either choose a code based on some card code now in use, or choose a code based on somebody else's proposed card code, or design a completely new card code. The last of these possibilities is repugnant to me, for two reasons. First, if all other things were equal, we might as well be compatible with something (e.g. Univac I) as with nothing at all. Second, one important reason for supporting punched cards in Multics is to allow

data on cards to be processed on keypunches, sorters, etc. before or after the data is processed under Multics. A sorter is designed to do what it does, not something else, and manufacturers of sorters will not contemplate seriously an order for a few non-standard sorters. Existing card codes and existing proposals have been greatly affected by this fact, and it would be frivolous to start all over again from scratch.

If we choose a card code based on an existing or proposed card code, there are six card codes which are relevant for consideration as a basis. They are:

1) The 48 character card code of the IBM 7094

2) The 64 character card code of the GE Computer Department

3) The EBCDIC code for IBM 360, as described, for example, in IBM Form A24-3312-2

4) The EBCDIC code for IBM 360, as described in IBM Form A22-6821-2

5) The proposed ASCII card code now being voted on by section X3 of ASA

6) The alternative ASCII card code developed by section X3.2 of ASA.

As an indication of the differences between the codes, it may suffice to point out that the 7094 card code uses the punching 12-4-8 to represent), the GE Computer Department code uses 12-4-8 to represent], and the two EBCDIC codes use 12-4-8 to represent <. + is represented by a 12 punch in the 7094 code, by 12-0 in the GE code, and by 12-6-8 in the two EBCDIC codes. The 12-0 punch which represents + in the GE code does not represent anything in EBCDIC, and 11-2-8, which represents ! in one EBCDIC and [in the other EBCDIC does not represent anything in the GE code, which represents [by 2-8 and ! by 0-7-8. 0-7-8, in turn, stands for ? in EBCDIC, while 2-8 represents : in EBCDIC. And so on. The only compatible subset of the 7094, GE and EBCDIC codes is composed of the letters and digits, and the proposed code being voted on by section X3 of ASA is not compatible even with this subset.

I believe we can in effect ignore the two ASA proposals of the moment. They are widely divergent from each other, X3 is apparently going to reject one of them in toto, and the

other would require substantial revision to gain acceptance by X3. We cannot at the moment base a card code on EBCDIC, since there are at the moment two EBCDIC card codes published in official IBM manuals, each described in effect as being the only true EBCDIC; inquiries about IBM's internal views yield inconsistent responses from people who should know. The difficulty with choosing either the GE computer department code or the 7094 card code as a basis for ours is that these codes are guaranteed to be incompatible with EBCDIC, a vast hindrance to communication between, say Holmdel and Indian Hill, or between Project MAC and the MIT computation center.

This brings us to the alternative of waiting. How long should we wait, what are we waiting for, how much will it cost us, and what should we do in the interim? I believe it is hopeless to wait for ASA to reach a concensus. We plan to be running Multics before ASA seems likely to select a card code. Hence, if we wait we can only be waiting for IBM to make a choice between its competing versions of EBCDIC. This seems likely to happen within a few months, at most; 360s are being delivered with software, and the software assuredly does something or other; for example, initial delivery of 360 PL/I to customers will supply a de facto answer to the question of which EBCDIC is the real EBCDIC.

If we wait for a resolution of EBCDIC, we will in the meantime be using some card code on the 64.5. Such a code has been proposed by D. E. Joel in a memorandum to E. R. Vance, dated April 4, 1966. Mr. Joel's proposal seems to me to be largely an excellent one; I have specific objections to minor points which I shall describe in another document. Mr. Joel's proposal would also serve as an excellent initial proposal for a Multics final card code based on the GE Computer Department card code.

Since the entire subject of card codes is so confused, I propose to adopt the following policy in planning work on the I/O system, unless instructed to do otherwise.

1) I shall assume that choice of a card code for Multics will not be made until after IBM has resolved its current confusion concerning EBCDIC.

2) I shall assume that in the interim we will use D. Joel's proposal card code, or some minor modification thereof, for those card decks required in Multics I/O system development. I shall try to minimize the number of such card decks.

3) I shall endeavor to ascertain as soon as possible which EBCDIC will be supported by IBM.

4) When I know what EBCDIC is, I will submit two proposed card codes, one based on EBCDIC, the other based on the 64.5 card code.

5) Except as specified in items 1 to 4, I intend to avoid the subject of card codes in the future.

Sincerely yours,

Vic Vyssotsky

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