EMOTION, APPETITE AND THOUGHT

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A programming manager typically has only a few minutes of personal contact with a candidate for a senior programming position. This is indeed a short period of time for objectively determining whether or not there is a proper match between such an expensive resource and a critical position. And, of course, the potential employee has just the same period of time for trying out his ideas and ideals on the manager. The resume and/or application are of little help in identifying the key topics that should be pursued, and to the extent that references would be of greater value, they usually are not available at this crucial time.

The present work seeks to develop a questionnaire that will assist both participants in preparing for a forthcoming interview.

PERSPECTIVE

I have been exposed to experienced programmers and their management for eleven years, and for eight of those eleven years I have had a direct responsibility, if not a need, for selecting highly qualified and experienced programmers. For the most part, this responsibility has been exercised within the confines of a computer manufacturer's development laboratory. But a fair amount of time has also been spent in the applications and educational environments. Out of this background comes the observation that experienced programmers take little time and have little trouble arriving at firm and rather accurate evaluations of their peers, employees and managers. At the same time, the selection process for these same experienced programmers is usually poorly organized, poorly executed and, in this light, believably ineffective.

What follows then, will be the consequence of a file that accumulated frustrations and occasional successes over the years. Training or experience in testing or counseling cannot be reflected, and the personnel departments have yet to have their say. Only in the past few months has the attempt been made to formalize the ideas into a single document and gain some first impressions as to their usefulness.

SITUATION

Let us suppose that a company is seeking to fill one or more programming positions. The size of the company, the nature of its business and the place of programming in its operation are unimportant. Obvious candidates for the position do not exist, or for one reason or another, they have been eliminated. A person who represents a relatively unknown quantity is to be considered for the job. He has been identified by one of the usual means: personal referral, advertisement, resume selection, etc. He is known to claim the basic abilities and a sincere interest in the position. He may work for a different organization or

the same one. In any case, an in-depth interview (not a sales pitch) by responsible management and staff personnel is clearly indicated. The position may involve most any aspect of the programming profession: management, staff or development; research, implementation or maintenance; systems, scientific or business. But the nature of the work has been judged to require an experienced professional, one with from four to ten years of involvement with programming.

Actually, it is likely that the organization, and even the specific interviewer has a direct interest in filling more than one position; and no definite judgment has been made as to which position represents the best match for the particular prospect. Indeed, it is likely that the prospect is less than a hundred percent sure of what his next step should be. Even if there is only a single opening, the chances are that some internal organizational adjustments are being considered in conjunction with the vacant position. Thus, a really useful instrument will not only assist in determining the applicability of an individual for a particular position, but will, in a more general way, address the individual's interests and strengths as well as the company's requirements.

More than one interview will probably be scheduled for an applicant of the type being considered here; and to date, there is no reason to believe that the degree of usefulness of the questionnaire is affected by the number of interviews in which it plays a role. So, in general, we will be talking about an interview that is actually one of a family of interviews which pertain to either a single job or a set of alternatives.

The individual on the other side of the table from the prospect understands the importance of selecting good people. He is not satisfied with his record, but feels that the developing intuition of his management team offers as reliable a measuring instrument as can be expected. After all, how can he expect to accurately measure the appropriateness of a prospect in the limited time available when the problem of evaluating his current staff seems to be so difficult and ill-defined? If he had some spare time, he would try to formalize a selection strategy. He feels that there are certainly questions that ought to be raised and the resulting answers carefully considered. However, it seems certain that most of the questions are firmly implanted in the interviewing procedure and most of the remainder are simply natural consequences of direction that the conversation takes. How is it then, that he so often leaves the interview with such a neutral impression of the applicant – hard pressed to fill out an evaluation form? Well, the interview was too short, and he had to leave in the middle of a budget meeting in order to get there. Besides, the man looked pretty good and seemed to know what he was talking about – and there were so many impressive things to tell him about the company, its plans and benefits. The interviewer suspects that the company will be lucky to get the man, even if he is half the programmer that he seems to be; what with other openings that are available and the ever-increasing work load.

OBJECTIVES

A meaningful dialog between prospect and responsible management team is the primary objective of the questionnaire. Such a dialog will make efficient use of available time while focusing attention on pivotal subjects. A "structured interview" is not an objective of the instrument, though it is expected that

more extensive experience with the instrument will yield valuable inputs concerning the feasibility and desirability of a more rigid interview format.

It is inevitable that this type of document will be used to associate various kinds of numbers with the candidate; but again, that is not a present intent. It is true that the questionnaire does seek to measure or sense a candidate's ideas, ideals, inclinations, basic knowledge and professional skills. But no attempt is made to associate values with the different questions, and for that matter, many of the questions do not have widely accepted "correct" or "incorrect" answers. Instead, the questions have been chosen and worded with discussion value as the fundamental criterion. If certain claims of the candidate – or interviewer – are audited as a result of his responses or defense of same, then that is fine; but the only measurement that is anxiously sought, is that gross two-valued one that comes when two professionals have a meaningful discussion of subjects that are of common interest.

PREPARATION

Initially, it was expected that several variations of the questionnaire would be required. Any given organization and/or manager would then be able to select the most appropriate version for any given situation. Some thought was given to logistics that would encourage the responsible party to tailor a set of questions to the particular position-applicant combination that was to be faced. Some questions were even left incomplete in anticipation of further tailoring. Preliminary studies, however, indicate that these degrees of freedom are not likely to be fruitful. The required investment of time approaches or passes the breaking point; the information required to make proper choices is likely to be the very information that is being sought; and finally, there appears to be an alternative that accomplishes much the same purpose and in a way that is much more palatable to the parties (or, at least the prospect) involved.

It is proposed that the interviewer fill out the same questionnaire; and under the same circumstances that will later confront a prospect. That is, he should not have any "a priori" knowledge of the questions; he should be given the same amount of time; and the same kind of a dialog with a "superior" should follow. This is not to say that he may not choose to do some additional preparation after this trial and before actual interviews. But it is the results from this particular exercise that will represent a most important calibration for himself and for the candidates who will later participate in interviews with him. Also, it has been found that the promise of an exchange of comparable results and the eventual fulfillment of that promise goes a long way towards demonstrating a sincere desire for a two-way exchange of information; and thus puts the candidate substantially more at ease while he is filling out the questionnaire and participating in the interview. Results verify that candidates do appreciate this gesture and feel that it materially enhances the value of the interview. Reactions from management vary from "You're mad!" to "This is a very appropriate way to begin a healthy employee-manager relationship."

Unconstrained, people have taken from one to two hours to complete the questionnaire; with the average being somewhat greater than an hour and a half. More recently, a limit of an hour and a half has been imposed in recognition of the investment that both sides of the table seem willing to make. No data is

available on the net effect of this time limit, but intuitively, the limit seems to be in line with the basic "pump priming" objective.

A questionnaire and a pencil is all that is required in the way of materials; and the environment is not particularly important. At interview time, a copy of the interviewer's completed questionnaire is also required.

QUESTIONS

The title (taken from Plato) attached to this note suggests that an experienced programmer's interview should sample his appetite, his emotions and his thought processes. Some would suggest that at least two of these factors and perhaps all three will be sampled in a non-trivial fashion the minute he is presented with any kind of a questionnaire, regardless of its nature or specific content. Certainly, the observation is true in some measure, and later, we will address the usefulness of that particular sampling as function of its potential cost (i.e., an unhappy candidate).

The present version of the questionnaire uses forty-six questions (some having several parts) in an attempt to identify key topics that should be discussed in forthcoming interview sessions. About fifteen percent of the questions ask for preferences, thirty-five percent ask for facts, and the remaining fifty percent ask for judgments. Some thirty percent address working conditions, professional involvement and objectives, thirty-five percent are concerned with hardware and software, five percent with systems, mathematics and logic, and the remaining thirty percent inquire about project management. These percentages are neither intentional nor advocated, but simply reported. In fact, the only thing deliberate about the questions is the difficulty involved in attempting classifications such as the above. The list of questions will require regular review if its timely nature is to be retained.

Typically, eighty-five percent of the questions are answered and none of the current set has stood out as being particularly objectionable. In fact, present evidence indicates that the current set of questions is quite excellent from a "pain prevention" point of view; and only slightly less adequate from a "stimulation" point of view. When it comes to "breadth or scope," it has been suggested that business data processing is not adequately represented; and, consequently, a candidate with substantial background and/or interest in that direction will not be approached properly. The sources of this suggestion have not been very helpful in identifying the crucial aspects of business data processing, and I must confess a suspicion that the characteristics that have tended to distinguish business data processing as a unique area of application, are rapidly disappearing from the scene. Nevertheless, some attention should be paid to the suggestion.

By far, the most frequent observation about the questionnaire has been that it is too long. This, in turn, has tended to reopen the question of tailoring subsets for particular position-applicant combinations. But for previously mentioned reasons, tailoring of this variety continues to be rejected. There has also been a temptation to count on the accumulation of experimental data to weed out less useful questions, thus reducing the length of the questionnaire. So far, however, growth has equaled decay. There has been a modestly successful attempt at reducing the impact of the questionnaire's length by emphasizing, in

the instructions, that the intent is to survey and that no one is expected to respond to all of the questions. In any case, the unanswered questions are nearly always a reflection of an acknowledged lack of interest and/or experience.

INTERVIEW AND SEQUEL

With the single exception of suggesting that the two participants exchange comparable results, no instructions are given about the role that the completed questionnaire is to play during the actual interview.

A key for the questionnaire has been recommended and is under consideration. As envisioned, the key would discuss each question in turn. The intent of the question would be explored and, where appropriate, answers, sets of possible answers, incorrect answers, and/or sets of incorrect answers would be given. In the case of the questions that ask for judgments (fifty percent of the total), one might seek to discuss various approaches to the issue, indicating the more obvious strengths and weaknesses of various approaches. One might also attempt to associate typical responses to a question with the "kinds of people" that make those responses. And, finally, a profile of the candidate based on his complete set of responses could be sought.

Even if the data were available to produce such a key, there are serious questions concerning its legitimate uses. There would seem to be no place for the key in an interviewing process like the one postulated here. For to use that kind of information in preparing for, carrying out, or evaluating the results of an interview would be to substantially downgrade the importance of a dialog *per se* as an aid in the programmer selection. Instead, one would be making the decision to conduct oral examinations. One manager has suggested that he would like to give a key for this questionnaire to his programmers as an indication of the dimensions of the programming profession, and as an aid in planning for their professional development. If this work could contribute in that direction, it would, for that result alone, have been worthwhile. But that kind of use is hardly consistent with the objective of providing a timely and provocative stimulant to conversation. Finally, there is the almost irresistible urge of responsible organizations and managers to use even the most flimsy yardsticks to perform critical personnel measurements. In fact, this latter observation is indicative of the difficulty mentioned most often by management in connection with the present questionnaire.

There is a desire for using completed questionnaires, subsequent evaluations, "offer-accept" decisions, and finally, performance and satisfaction judgments (i.e., the source materials for a key) as inputs to subsequent developmental work in this area. The gathering and constructive use of this information can probably be accomplished without compromising the objectives of the instrument; but there are certain logistical problems. For instance, how can the candidate be assured that his responses will not follow him out of the interview? Perhaps the effect of discarding the questionnaires can be achieved while still making them available to an "outside organization" for developmental purposes.

VALIDATION

While technical, professional, managerial and psychological judgments can be (and have been) obtained, the ultimate measurement of the usefulness of this particular instrument must come from the reactions of those who use it and from the performance and satisfaction of those who are subsequently offered positions and elect to accept them. For now, we can only report that initial reactions from both management and nonmanagement personnel have been quite encouraging. From the applicant's point of view, the questionnaire is taken to be a demonstration of definite interest and methodicalness. It is also said to be of assistance in placing one's interests and abilities into proper perspective. No one has admitted to being upset by the questionnaire or the process. From the manager's standpoint, there is concern about the time requirement and the applicant's attitude; but more importantly, there is a pronounced desire to pursue the possibility of using the instrument in one way or another.

THE QUESTIONNAIRE

A current iteration follows.

A QUESTIONNAIRE FOR EXPERIENCED PROGRAMMERS

PURPOSE: To stimulate dialog on pertinent subjects.

GROUND RULES:

(a) Answer as many questions as you wish. This is a survey of interests and concerns; and no one is expected to respond to all of the items.

(b) You have an hour and a half to complete the questionnaire.

(c) No grade or score will be associated with your completed questionnaire. Indeed, many questions do not have a "correct" or "incorrect" answer. Other questions have a number of valid answers.

(d) At interviews, the second party and yourself will exchange papers. He will have filled out an identical form. And the two of you will use the resulting information as much or as little as seems appropriate to the direction of the discussion.

(e) After the interview your copy of the questionnaire, along with that of the second party, will be discarded. So, do not hesitate to mark on either of them as you see fit.

1. How can you tell when an individual is putting in too many hours at his profession?
2. What do you feel is the most healthy manifestation of competitiveness among peers in a data processing organization?
3. Number the following professional objectives in accordance with their relative importance to you (the number 1 should be given to the most important).

_____ Specific assignment
_____ Compensation
_____ Security
_____ Recognition
_____ Contribution
_____ Challenge
_____ Colleagues

4. To what extent do you feel that your ordering of professional objectives coincides with those of your colleagues?
5. Do you believe that staff positions can be as attractive as managerial positions?
   Under what conditions?
   How about for you in particular?

6. What do you see as being the relative merits of working for a large company (or institution) as opposed to a small one?
   Advantages:
   Disadvantages:
7. What do you see as being the relative merits of working for a computer user as opposed to a computer manufacturer?
   Advantages:
   Disadvantages:
8. Number the following considerations in accordance with their relative importance to you and your family (the number 1 should be given to the most important).

   _____ Recreational opportunities
   _____ Geographical location
   _____ Cultural opportunities
   _____ Climate
   _____ Educational opportunities
   _____ Other (explain)

9. Since you have been following the computing profession, what would you say has been the most important hardware development?
10. The following statements describe items that are common to many digital computers. What item would you say most closely fits each description?
    _____ A. May be used to dynamically modify the address referenced by certain instructions
    _____ B. Can control several I/O units simultaneously
    _____ C. When a branch instruction is executed, the contents of its address field is placed here
    _____ D. The normalization of a floating-point number sometimes results in the addition or subtraction of a value from this field
    _____ E. In the case of single address arithmetic instructions, this unit is usually the implied source of one of the operands
    _____ F. Its length often places a limit on the amount of internal memory that can be attached to a computer system
    _____ G. Commonly used to detect transmission errors that occur internal to a central processing unit
11. The following statements describe facilities and operations that are common to many digital computers. What facility or operation would you say most closely fits each description?
    _____ A. When this facility is used, the operand of interest occupies a field within the referencing instruction
    _____ B. Involves the preservation of an address and a branch
    _____ C. Sacrifices accuracy to facilitate scaling
    _____ D. Facilitates the combining of a collection of programs of arbitrary length at load time

_____ E. One operand is used to select portions of a second operand
_____ F. The addressed location contains the actual address of the desired operand
_____ G. Captures control from the operating program

12. Each of the following excerpts is from the description of an instruction for a particular computer. Indicate what type of instruction (i.e., fixed point arithmetic, comparison, shift, input/output, . . .) is probably being described.
    _____ A. . . . with zeroes copied into vacated positions on the right.
    _____ B. If a data transmission order has been sent to a device, . . .
    _____ C. . . . if both are zero, a zero remains in . . .
    D. . . . 32 bits, and loads the integer remainder . . .
    _____ E. . . . the instruction pointed to by the effective address of the . . .
    _____ F. . . . consists of a sign, a biased base 16 exponent, which is called . . .
13. List ten manufacturers of digital computers.
14. Identify a problem that would be better handled by an analog computer than by a digital computer.
15. What is the first characteristic that occurs to you in connection with each of the following computers?
    1401
    System 360
    B5000
    6600
    1108
    705
    PDP8
    940
    1800
16. On the basis of your experience, what computer would you suggest for each of the following jobs?
    Payroll for a small company _____
    Controlling traffic lights _____
    On-line Fortran for 25 users _____
    Matrix inversions (max 100 X 100) _____
    Management system for a large company _____
17. The boxes that make up the following matrix are to be filled in with designations of items or categories of computer hardware that most appropriately match the coordinates. For instance the box at the intersection of "Batch Input" and "Slow" should be filled with the name of a slow, batch input device. Either brand names or types of devices may be used.
18. Since you have been following the computing profession, what would you say has been the most important software development?

	Cheap	Expensive	Common	New	Slow	Fast
Batch Input						
Remote Input						
Main Memory						
Arithmetic Unit						
Batch Output						
Bulk Storage						

19. Number the following characteristics from 1-11 in accordance with your judgment of their relative importance (the number 1 should be given to the most important). Two sets of numbers are called for.

Systems Programs (e.g., Compiler)	Application Programs (e.g., Payroll)	
_____	_____	Ease of use from a programming point of view
_____	_____	Speed of execution
_____	_____	Documentation
_____	_____	Debugging aids
_____	_____	Ease of use from an operating point of view
_____	_____	Compatibility across machine lines
_____	_____	Ability to modify
_____	_____	Minimization of core storage
_____	_____	Modularity
_____	_____	Check point and restart
_____	_____	Machine independence

20. What would you say is the most obvious software characteristic that is missing from the list given in the previous item?
21. In what programming language is each of the following statements written?

    _____ A. TA := TA + 1;

    _____ B. TA = TA + 1

    _____ C. COMPUTE TA = TA + 1.

    _____ D. TA = TA + 1;

    _____ E. <TA> : : = <TA> + 1

22. For each of the languages identified in the previous question, give the first advantage and the first disadvantage that occurs to you.
    A. Advantage:
       Disadvantage:
    B. Advantage:
       Disadvantage:
    C. Advantage:
       Disadvantage:
    D. Advantage:
       Disadvantage:
    E. Advantage:
       Disadvantage:
23. Describe the following elements of software support:
    A. Macro
    B. Closed subroutine
    C. Buffer
    D. Checksum
    E. Checkpoint
    F. Literal
    G. Argument
    H. Linked list
    I. External reference
24. Characterize the following:
    A. Dynamic Programming
    B. Higher-Order Simplification
    C. First-Order Prediction and Control
    D. Digital Simulation
25. Identify the following:

    ____ A. 2.718

    ____ B. $\frac{n(n+1)}{2}$

____ C. $X^n + nx^{n-1}y + \frac{n(n-1)}{2!}X^{n-2}y^2 + \frac{n(n-1)(n-2)}{3!}X^{(n-3)}y^3 + \cdots$

____ D. $V_1V_2 \cos \theta$

____ E. $\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{N}}{N}$

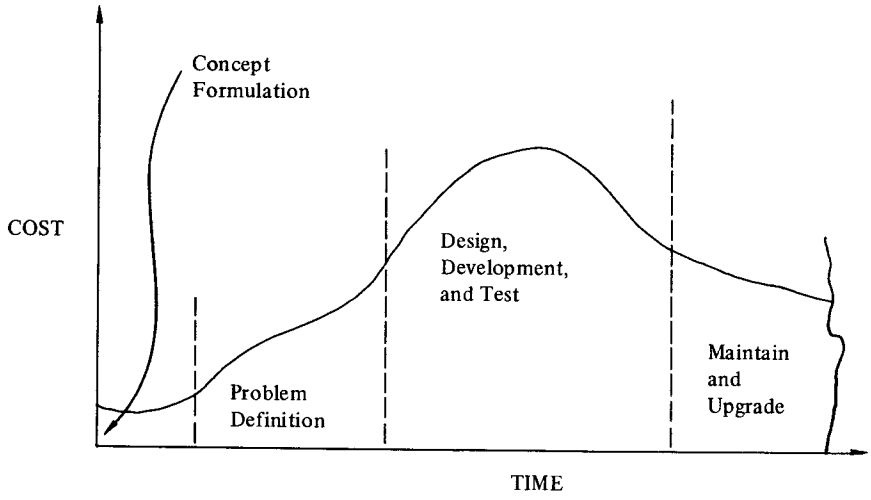
____ F. $\frac{1}{3}h\left((y_o + y_{2m}) + 4(y_1 + y_3 + \cdots + y_{2m-1}) + 2(y_2 + y_4 + \cdots + y_{2m-2})\right)$

____ G. $\frac{X^2}{a^2} + \frac{y^2}{b^2} = 1$

____ H. $A = P(1 + i)^n$

26. Identify the following:
    A. Truncation error
    B. Multiple regression
    C. Jordon elimination
    D. Convergence
    E. Difference equations
    F. Muller's method
    G. Central differences
    H. Monte Carlo methods
    I. Hermitian matrices
    J. Orthogonal polynomials
    K. Eigenvalues
    L. Associative law
27. Since you have been following the computing profession, what would you say has been the most important marketing development?
28. Why do large programs cost many times as much as small programs on a per-step basis – or do they?

29.



Comments?

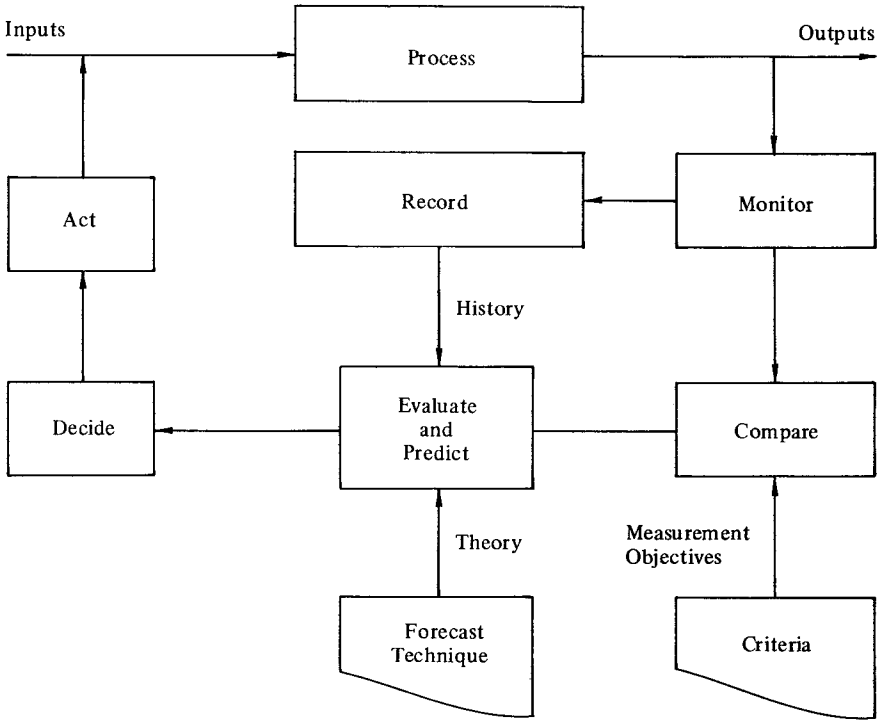
30. What percentage of the "design-development-test" budget would you expect to be spent on each of the following line activities?

System Design	_____ %
Component Design	_____ %
Flow Charting	_____ %
Coding	_____ %
Unit Test	_____ %
Component Test	_____ %
System Test	_____ %
TOTAL	_____ %

31. How about the support budget?

Machine Operations	_____ %
Documentation	_____ %
Test Development	_____ %
Control and Administration	_____ %
TOTAL	_____ %

32. What cost items have been omitted from the two previous items?
33. What do you consider to be the pro's and con's of "hands-on" debugging?
    Pro's
    Con's
34.

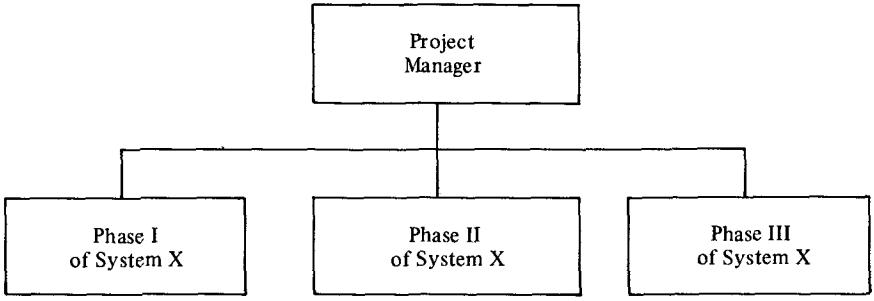


Comment on the above diagram as a description of the process of managing a programming project.

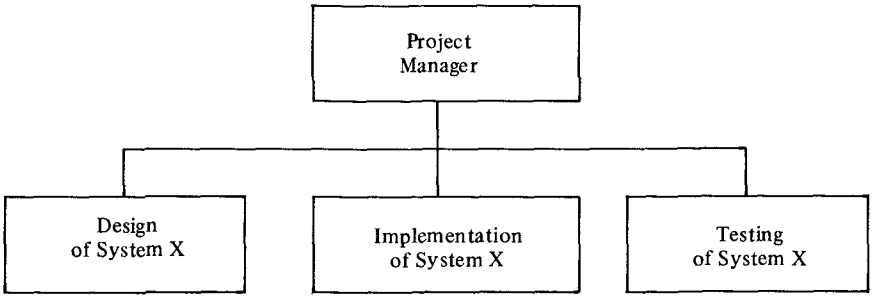
35. As a programming manager, how would you use computers to assist in the performance of your job?

36. Discuss the relative merits of the following two project organizations.

(1)



(2)



37. Considering your own personal experiences, number the following factors in accordance with their relative importance as factors in selecting programmers (the number 1 should be given to the most important):

_____ Age
_____ Educational background
_____ Grades in mathematics
_____ Grade point average
_____ Language ability
_____ Liking for chess, bridge, puzzles, etc.
_____ Experience

38. Identify the following people:

Saul Gorn
John Backus
Allan Perlis
George Forsythe

A. M. Turing
Allan Newell

39. Characterize the following periodicals:
    A. Datamation
    B. Communications of the ACM
    C. Journal of Machine Accounting Systems and Management
    D. Scientific American
    E. Data Processing Digest
    F. Journal of the ACM
    G. Business Automation
40. Identify and/or explain the following acronyms:
    PERT
    GIS
    CAI
    POL
    SJCC
    IAL
    ACM
41. Number the following activities in accordance with your judgment as to their relative importance (the number 1 should be given to the most important):
    _____ Reading the professional literature
    _____ Attending professional meetings
    _____ Having lunch with various colleagues from time to time
    _____ Intra-company meetings
42. To this point in your career, what do you consider your most important achievement?
43. To this point in your career, what do you consider to be your most significant failure?
44. What do you think of this questionnaire?
45. List five questions that you would add to this questionnaire.
46. List the numbers of the five questions presented in this questionnaire that you feel are least important.