A Test Method of Background Questionnaire in Programme for the International Assessment of Adult Competences (PIAAC)

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Abstract: PIAAC is new international assessment by OECD, and targeted for adults from 15-year-old to 65. PIAAC assesses Numeracy, Literacy, Problem Solving in Technology-rich Environments, and Background Questionnaires (BQ). BQ is an important position among the survey data in PIAAC. Each participates country does not miss the actual test, for loss of data is not allowed. Therefore test pattern will be reduced with the technique of the combinatorial test; none of all combinations but all pairs of the variables. Applying this method, in the first half there are 30 patterns and the latter half there are 17 patterns, comparatively. The combination inclusion rate between two choices becomes 100%. Time required for the BQ test was to shorten by one person for five hours.

Keywords: OECD-PIAAC, information literacy, test method, combinatorial test

Introduction

PIAAC (Programme for the International Assessment of Adult Competences) [1] is new international assessment by OECD. PIAAC is targeted for adults from 15-year-old to 65 whereas OECD-PISA is targeted for 15-year-old student. PIAAC is the most comprehensive international survey of adult skills ever undertaken. PIAAC will measure the skills and competencies needed for individuals to participate in society and for economies to prosper.

The International Consortium which mainly on the American ETS summarizes develops the concrete investigation method and means of PIAAC and Deutsches Institut für Internationale Pädagogische Forschung (DIPF) is in charge of the assessment system.
PIAAC assesses Numeracy, Literacy, Problem Solving in Technology-rich Environments, and Background Questionnaires (BQ). Most of the survey use laptop computer. In BQ part of the investigation, the investigator enters the PC hearing target audience's answer. Other three areas, the target audience oneself enter the answer to the PC to bring the subject of an investigator. If the target audience is difficult on a PC, he or she can also answer in writing.

1. The place of BQ in PIAAC

To include BQ in PIAAC is because to assess the relationship of adult competencies with economic and social outcomes is believed to underlie both personal and societal success (e.g., earnings, employment, educational attainment, participation in further learning) and optionally with additional outcomes or processes at the individual level (e.g., health, social

capital) or workplace level, and with transitions at key points over the lifespan, such as school-to-work and possibly other stages [2].

BQ contains following 7 areas [3]: General Information (Age, Sex), Education and Training (Highest level of formal education, Field of study highest qualification), Current status and Work history, Current or recent work, Skill Use Literacy (Numeracy and ICT: Reading skill use, Writing skill use), Personal Traits (self-discipline, Locus of control), and Background information (Household composition, Children). BQ system in computer is implemented by two parts: the first half is General Information, Education and Training, and Current status and Work history. The latter half is Current or recent work, Skill Use Literacy, Personal Traits, and Background information.

2. Test Method about BQ system

As mentioned above, BQ is an important position among the survey data in PIAAC. Although the system will create and test of the International Consortium in charge, each participates country does not miss the actual test. There is a part of investigators to enter the data, for loss of data is not allowed, it is necessary to perform the test reliably.
As for the number of the items of BQ is 500 and choices is 13 in maximum, the number of the divergence is 24. Effective inspection is necessary because test pattern emits when test as it is. Before mentioned, BQ system consists of two parts, but still there is much test pattern. In addition, as for the part, as for the part, it is 6*5*4*3 = 360 patterns in the first half, and 310*29 = 30233088 patterns in latter half even if the equivalent division by the combination of simple round robins.

Therefore test pattern will be reduced with the technique of the combinatorial test; none of all combinations but all pairs of the variables. It is thought that it is effective when the combinatorial number of tests is very big like BQ. Specifically, a combination list is made by the standard collection method after divided equivalently an individual choice and reduced the number of the standards. The bug between all 2 factors must detect it. And the combination of multiple factors (more than 3 factors) bug has rarely occurred.[4] If bug detection rate is p, bug detection rate between 2 factors is p^2 and that between n factors is p^n. For example, if p = 0.004, detection rate between 2 factors is (0.004)^2 and 3 factors is 0.000016, 0.000000064, comparatively.

Table 1: Test of All Combination (Round-Robin Test)

	P1	P2	P3	P4
Test Case 1	0	0	0	0
Test Case 2	0	0	0	1
Test Case 3	0	0	0	2
Test Case 4	0	0	1	0
Test Case 5	0	0	1	1
Test Case 6	0	0	1	2
Test Case 7	0	0	2	0
Test Case 81	2	2	2	2

Table2: Combinational Test Table

	P1	P2	P3	P4
Test Case 1	0	0	0	0
Test Case 2	1	1	1	0
Test Case 3	2	2	2	0
Test Case 4	0	1	2	1
Test Case 5	1	2	0	1
Test Case 6	2	0	1	1
Test Case 7	0	2	1	2
Test Case 8	1	0	2	2
Test Case 9	2	1	0	2

If test item = 4(P1/P2/P3/P4) and standard = 3(0/1/2) (See Table 1), test pattern is 3^4 = 81 with all combination, 9 with orthogonal array (combinatorial test; Table 2). The test result is provided 100% inclusion rates between 2-pair factors in a one-ninth test item,

approximately equal to all combinations test. Figure 1 shows the transition of the equivalent division (State Transition Diagram).Each state (ellipse) represents one question in BQ. For example, BQ_01aJP is one question item, ”What is your educational background ?”

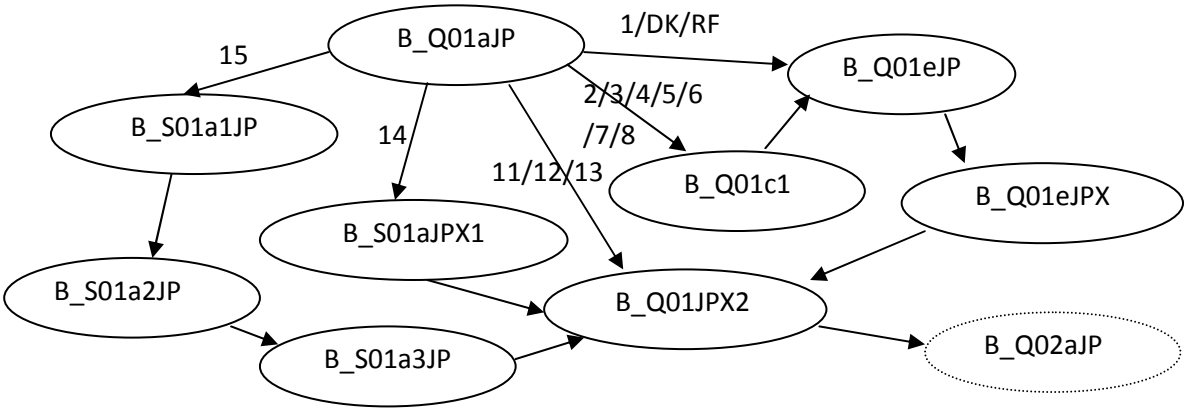

Figure 1: The State Transition Diagram rewritten by computer.
Item No. B_Q 01aJP may has range of 1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/DK(Don’t Know)/RF (Refused).

First, BQ items were divided equivalently an individual choice and reduced the number of the standards. As for the number of the standards in each the divergence, in the first half, there are one of 6 standard, one of 5 standard, one of 4 standard, and one of 2 standard and in the latter half ten of 3 standard, nine of 2 standard. Second, a combination list is made by the standard collection method by ALLPAIRS [5]. Applying this method, in the first half there are 30 patterns and the latter half there are 17 patterns, comparatively. The combination inclusion rate between two choices becomes 100%. To make a standard collection was used ALLPAIRS, which was free software. Time required for the BQ test was to shorten by one person for five hours. Without this technique, 6*5*4*3 = 360 patterns in the first half, and 310*29 = 30233088 patterns in latter half must be tested by the combination of simple round robins. It would be impossible.

3. Conclusion

PIAAC BQ is an important position among the survey data in PIAAC. Each participates country does not miss the actual test, for loss of data is not allowed. Therefore test pattern will be reduced with the technique of the combinatorial test; none of all combinations but all pairs of the variables. Applying this method, in the first half there are 30 patterns and the latter half there are 17 patterns, comparatively. The combination inclusion rate between two choices becomes 100%. Time required for the BQ test was to shorten by one person for five hours. 2nd PIAAC survey is under consideration by OECD Bulletin Board.

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