In this section, we explain and validate the method proposed in this paper through an example C program, denoted as P. Fig. 1 shows its source code and control ﬂow graph. The statements of P are labeled as 1 to 9.

P includes three conditional statements that are labeled as 1, 4 and 7, respectively. The aim of this experiment is to investigate the branch correlations of the three condition statements employing our method. The input vector of P is (A, B) with its domain being D(P) ¼ [2500, 500]2



Step 1: Estimation of conditional probabilities: First, deﬁne three stochastic variables X1, X2 and X3 corresponding to the outcome of conditional statements 1, 4 , an d 7, respectively, and let

Pi = p{X2 = 1|X1 = i}, i = 0, 1

p ′i= p{X3= 1|X2= i}, i = 0, 1

p′′i= p{X3= 1|X1= i}, i = 0, 1

Then, estimate the values of the above three parameters based on sampling. Stochastically sampling M input vectors in D(P). In general, in order to obtain representative samples, M should be large enough, and the M input vectors should distribute in various regions of D(P). Here, the value of M is set to 50. Therefore a set of samples {(Xi1, Xi2, Xi3), i = 1, 2,..., 50} can be obtained. In order to obtain the values of these samples, the original program should be instrumented appropriately. Fig. 2 shows the instrumented program of P.



Finally, estimate the values of pi , p′ I and p′′I by Theorem 3. Table 1 lists these estimates. In order to investigate the branch correlations of three conditional statements, deﬁne

pij = p{X3 = 1|X1 = i, X2 = j}, i, j = 0, 1



Employing the same approach as the above, the estimates of these conditional probabilities can also be obtained. Table 2 lists these estimates.







Step 2: Determination of branch correlations: We can observe from Theorems 1 and 2 and Table 1 that conditional statements (1, 4) have F - F correlation because of pˆ 0 being equal to zero; nevertheless, conditional statements (4, 7) and (1, 7) have no branch correlation because the values of p′I and p′′i(i = 0, 1) are all larger than zero as well as smaller than one.

For the case of three conditional statements, we can observe from the generalization of Theorems 1 and 2 as well as Table 2 that conditional statements (1 ,4 ,7 ) are TF -> F correlative because of pˆ1,0 being equal to zero; furthermore, because (1 ,4 ) are F -> F correlative, pˆ 0,1 has no practical meaning, and the result of Table 2 also verify this fact.

Step 3: Detection of infeasible paths: Based on these branch correlations of different conditional statements, we detect the following infeasible paths of P

