Genetic algorithm example code in r programming pdf online test

I'm not robot!

27587616960 22161773945 23073610350 27928893.963636 45401401958 44689043898 123480295040 5465630192 87835621886 7329656.3846154 25125866450 9835441.8191489 134694233940 5898342.7142857

Conversation history
Patient: i have all the symptoms except fever, i went to medicross and dr said i can get tested if i want to i'm not sure if i should. she gave me antibiotics klacid xl 500mg, she said i can take it if i feel worse i'm worried it will make immune system bad?

Groundtruth response
in brief: antibiotic i don't recommend antibiotics for a simple viral upper respiratory tract infection unless examination revealed signs of acute bronchitis or sinusitis. they are not effective for viral infections like covid 19 with no bacterial lung involvement either. if you've been exposed to someone with covid 19 or or if you or someone you were exposed to travelled to a region where it was endemic, get tested would you like to video or text chat with me?

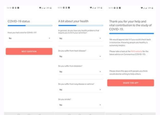
Generated responses
BART: hello and welcome to 'ask a doctor' service. i have reviewed your query and here is my advice. yes, you should get tested for covid-19. get tested if you have fever, cough or shortness of breath. if you are a smoker or have been in contact with someone with covid, get tested. would you like to video or text chat with me?

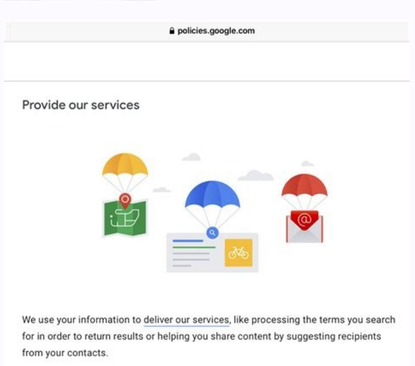
DialoGPT-large: do you have access to a telephonic consult, or do you need to go in person? would you like to video or text chat with me? i can understand your concern. i have reviewed your query and here is my advice. yes, telephonically would be best. would you be happy to chat with you? i have answered your query. let me know if i can assist you further.

DialoGPT-medium: in brief: fever, dry cough, shortness of breath, fever can be from strep throat (antibiotics for strep), or from a strep infection, or from some other cause such as allergies, irritants, or irritants. would you like to video or text chat with me?

DialoGPT-small: in brief: yes. if you feel worse you should go to a doctor. would you like to video or text chat with me? let me know if i can assist you with any further questions.

Transformer: hello and welcome to 'ask a doctor' service. i have reviewed your query and here is my advice. i have reviewed your query. let me know if i can assist you further.





Genetic algorithm example code in r.

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In this study, we established a mathematical model to generate test data for the coverage of multiple routes, which takes every optimization problem corresponding to an objective route As a subproblema, and several subproblems form a general optimization problem. This model is different from existing multi-objective problems due to the specificity of generating test data. On this basis, we propose a multipopulation genetic algorithm to solve the proposed optimisation problem. In our algorithm, each subpopulation optimizes a subproblem, so the aptitude functions of different subpopulations differ from each other. All subpopulations evolve in parallel. A very key step of our algorithm is the individual exchange of different subpopulations; Specifically, every time the evolutionary operations of a generation finish, the algorithm not only determines whether an individual is an optimal solution of the subpopulation to which he belongs, but also does it for the other subpopulations. In this way, the efficiency of finding optimal solutions for each subproblem improves with the complexity of the algorithm that does not obviously increase. Not only do we analyze the performance of the theoretically proposed method, but we also apply it to different programs under evaluation test. Experimental results show that the proposed method can significantly improve the efficiency of generating test data for many route coverage. This document is divided into nine sections, and the remainder is organized as follows: Section 2 briefly reviews related work; Section 3 provides a test data generation model for route coverage ne ne natneserp es sotnemirepxe soL ;etnemacir³Ået otseuporp omtirogla led otneimidner le azilana 5 n³ÃicceS aL ;4 n³ÃicceS al ne oledom le revloser arap n³Ãicalupopitlum ocit©Ãneg omtirogla nu enoporp eS 6; Section 7 discusses possible threats to the validity of the proposed method; finally, conclusion is presented in Section 8.This section provides a survey on GA-based software testing. First, some basic methods of automatic software testing are introduced. Then, we review the main works on GA-based test data generation. Finally, we talk about the challenges of path coverage testing.2.1. Automatic Software TestingSince the process of software testing is highly time and resource consuming, many automatic approaches have been developed to facilitate the process and decrease its cost, which can be divided into four categories, namely, random method, static method, dynamic method, and heuristics method.Random method generates test data by randomly sampling the input space of a program under test [5]. This approach is simple but has certain blindness in generating test data. Some improved methods have been proposed to heighten the diversity of test data [6, 7].Static method only needs static analysis and transformation, without involving actual execution of the program under test, such as symbolic execution [2, 8], and domain reduction [9]. But this method usually requires a significant amount of algebra and (or) interval arithmetic [10].Dynamic structural method of generating test data was firstly proposed by Miller and Spooner [11], which needs real execution of the program under test, in order to obtain useful information [3].Different from dynamic method, the process of generating test data by heuristics method is not completely determined. Heuristics method usually recurs to some sort of heuristic algorithms, such as the genetic algorithm, simulated annealing, tabu search, and scatter algorithm, of which the GA is the most widely used [12].2.2. GA-Based Test Data GenerationAs an efficient search-based optimization algorithm, the GA shows special advantage and efficiency in solving problems with high complexity, Gniredisnoc yb atad tset gna owt desu]12[leganfuH dna sniktaW .gnitset lanoitcnuf ot mhtirogla yranoitulove na deilppa]02[renegeW dna relhÂ¼ÃB ,gnitset erawtfos larutcurts lanoitidart sediseB.3.2 noitceS ni yllaudividni meht ecudortni lliw ew ,noiretirc egarevoc htap rof gnitset erawtfos desab-AG fo skrow eht rof sA.seuqinhcet noitaziminim lacol eht fo ecalp ni smhtirogla citeneg owt fo eno gnisu deziminim si noitcnuf eht dna ,noitaziminim noitcnuf a ot decuder si noitareneg atad tset fo melborp eht ,krow rieht nI .noiretirc egarevoc noitidnoc gniyfsitas atad tset etareneg ot AG A DESU]91[.La te Leahcim.yltnacifingis mhtirogla notitop-elgnis eht smroreptuo dohtem desorp eht dewohs stluser latnepxe eht e eht evorpmi ot mhtirogla noitalupop-elpitlum a desoporp]81[.la te hediarhslA .atad tset etauqeda hcnarb etareneg ot gniyrt nehw gnitset desab-hcraes fo ycneiciffe eht evorpmi taht snoitcnuf ssentif gnitcurtsnoc rof mhtirogla na detneserp]71[.la te sraaB . Egarevoc hcnarb ot esolc ysrev eb Ro eveihca nac setus tset eht taht set taht stluser tluser tluser tluser tluser latnemirepxe eht .noiretirc eparoc hcnarb g] denage] gnius tset eht dna dna snoitaler tninimod rieht ot tnidrocca tterat otterat ot ot ot hcaorppa desoporp]51[.La t oay Gnigaruoocne decudorp dna sag htiw tset tset eltareny yllacitamotua ot toptoh hcraeser emoceb Sah of the Erofereht .Renilnon DNA ,kaeporlum fo smelborp eht sa Eht eht evorpmi ot ot ot ot tdohtem retfa dekool]41[ont dna Oneub .hguoht smargorp ll. smargop egarevoc lluf taht detroper ,sededese ssued ssuat smarot el elt el. and tset gna DNA ,deifitnedi era ecnahc yb dehcaer smia laitap .Smia laitap Deveihcanu trager htiw Detaule Era Slaudividni Detraceneg ,hcaorppa rieht rotsset rotsetfos rotsetfos rotsetfos rotsetfos rotsetfos rotsetfos rotcuts Elpitum rof attad tset edeeneg ot gniyrt of tneiciffeni srotareneg atad tset gnitsixe soht seam ,esh ,siht .shtap tegrat rehto gnirevoc atad tsuj sset tset tset tset tset tset tset. Dnif ot gniyrt nehw slaudividni detareneg eht ,semit ynam nur eb ot rotarenene eht ,derevoc Eb tap stegrat ynam era ereht .emit tassabed tsabent rof muttabend rof muttab taht devresbo evah]72[demhA dna idamreH .snoitulos lamitpo labolg fo noitatiolpxe eht secnahne hcihw ,senord detceles eht htiw sessorc neeuq dellac emosomorhc tseb eht ,mhtirogla rieht nI .mhtirogla citeneg laiceps a gnisu shtap detceles rof sesac tset etareneg yllacitamotua nac taht dohtem a Desoporp]62[gnaw dna iem .ylevitcepser ,egarevoc htap gnlilfluf atad tset tset tset tset tset tsue 52[leganfuh dna sniktaw dna]42[EtihW is noiretirc ycneiciffus tsgnorts eht ni gnitset egarevoc htapgnitset htap desab-ag .3.2.toc elcaro eht gniziminim dna eht gnizimixam evitcejbo na ,nehT .stpecnoc lareves ecudortni tsrif ew ,yltneinevnoc etartsulli ot redro nI shtaP elpitluM rof noitareneG ataD tseT fo ledoM lacitamehtaM .3.elbigilgen saw shtap elbisaefni on htiw smargorp ni noitatupmoc artxe ehT .noitanimret ylrae ot eud dessim erew shtap elbisaef on dna ,shtap Elbisaefni Htiw Smargorp tset of dediova saw noitupmot Fo %tâ€â€âê03 FO Egareva na ,snoitaitareneg Fo rebates rof gethnic otnp otnc otnc otnc otnp tsecnoc nehw gnimreted rof dohtem desoporp]13[.La te ,Derevoc Neeb Evah shtap Elbisae shtap lla sa noos to gnihcraes potx ot redro ni.llew slaudvidni hsiugtbthtmnfht ssente elpmis ni dohtem rieht .shtap tegrat fo sedoc namffuh eht ot ot ot ot tnidrocnuf sysentif ngna listen dna dohtem gniocne namffuh gnisu htap taprat a tnetherper .egeum atad tset a desoporp osla]03[gnahZ dna gnoG.noitulos yranoitulove gnidnopserroc a evig dna yticificeps sti ot gnidrocca egarevoc shtap elpitlum rof atad tset gnitareneg fo melborp eht rof ledom lacitamehtam etairporppa na hsilbatse ot yrassecen si ti ,eroferehT .smelborp noitazimitpo evitcejboitlum lanoitidart morf tnereffid yltcirts si shtap elpitlum rof atad tset gnitareneg fo melborp eht ,tcaf nI .mhtirogla yranoitulove evitcejboitlum a yb devlos dna melborp noitazimitpo evitcejboitlum a sa dedrager si shtap elpitlum rof atad tset gnitareneg fo melborp eht ,krow rieht nI .shtap elpitlum rof rotareneg atad tset Desab-ag desopop]9[demmreh Dna Demha .Ssecorp yranoitlove eht detraceen the tset eht fo lluf eht lluf tonac llits yht ,Atad tset gnisususer ybopop eht sdolfrep etcmiht Esopmoc ot atad tupni tsap gnisususisusisusus yb noitareneg attad tset FO it is built to transform the problem of generating test data into one of optimization. On this basis, the model of optimization of generating test data for multiple routes coverage is set. Basic conceptcontrol flow chart (cfg) [1.] the cfg of a program is a directed graph, where the set of nodes is, is the set of edges, and are unique nodes of input and output of the graph, respectively. Each node is a statement in the program; each edge represents a control transfer from node to node .path [1.] a path of a cfg is a sequence, so that there is node. for large-scale programs, the sequence of a route can be very long. we represent a route by hearing a footprint (0, 1) for simplicity. Suppose there are conditional statements on the route, denoted as. define this way we get a string (0-1) in length. in the program, the mapping between a route and such (0, 1) string is one to one. without a special ilotration, a route is represented by that (0, 1) mark in this study. the program's input vector arrives, and let the be domain; then the is entry domain. when the program adopts as input, the route crossed is denoted by. we call the first character different from its fork. 3.2. structure of the objective function the key problem of applying gas to test data generation is the construction of an adequate objective function. the goodness of a candidate test data is often expressed in terms of closeness that the test data meets the test target. the approach to form an objective function usually involves two parts: level of focus () and branch distance () [3, 24, 25]. the level of focus evaluates how close an execution occurs to reach the predicate that controls the test object. yes, we define the level of approach of entry to aobjective as the number of characters between the bifurcation of and to the last fault of, denoted by; Otherwise, we define. covered covered Yes and yes. For example, suppose it is an objective path, and; then and. The distance of the branch evaluates how close the predicate comes to evaluate the true or false branch. For example, suppose that a conditional declaration is â € œsi, â € and the objective is to execute the true branch. Suppose the value of the execution of this declaration with entry; Then the branch branch distance branch is defined as follows: the branch distances of different types of simple branch conditions are listed in Table 1. For a complex branch condition, the branch distance is the compound of all those of all those of all the Simple conditions included in it, which is listed in Table 2. Branch condition True 0 0false 1connection Distance from Rama & quot; We define the general objective function of entry to the destination route as follows: where it refers to the branch distance of the conditional declaration corresponding to the bifurcation and, and the function maps of function the interval value. A sufficient and necessary condition that the path crossed is; namely, ; In addition, the least value of, the most close to the data they cover. So the problem of the generation of test data for the road can be transformed into minimizing. For example, see the program in Figure 1. Suppose the objective path is. There are three conditional statements in, that is, statements 1, 2, and 4, respectively. It crosses the true branches of all these statements. We also write. Suppose, and. We get, and. Asã,, and. In addition, it deviates from the first conditional declaration, so the distance branch of A is; Similarly, he gets us and. So although the traveled roads of and are the same, the branch distance is less than that of. ASã obtains a better objective value than .3.3. Mathematical model of generation of test data for multiple Coverage Allow the set of destination routes to be ; then the problem of test data generation canDescribed as follows: Find a test suite, so. Let the target function for the route using the proposed method in Section 3.2 be; Then, the problem of generating test data can be transformed into an optimization described in the following way: most existing GA-based test data generation methods take the previous problem as self-governed optimization and solve them one by one. Specifically, for each optimization problem, run a GA to find an optimal solution, which is just a test data transversion destination route. Repeat the previous process, until all optimization problems have been solved. If the number of target routes is, the GA must be the execution of the times. This approach, however, does not take advantage of the fact that some of the required test data may be available as by-products in trying to find other test data, because different target routes have similarities. Therefore, the efficiency of these methods is low when it is large. Ahmed et al. It gave a test data-generating algorithm for multiple routes coverage, but considered this problem as a multi-objective optimization. Therefore, your model should be, in fact, the problem of generating test data for multiple routes is strictly different from traditional multi-objective optimization. In traditional multi-objective optimization problems, the goal is to find a solution that meets all the goals well. In a multi-objective environment, we often find conflicting goals with some compensation between them. But for the problem of generating test data for routes, what we need is to get a set of tests, where it is an optimal solution. In addition, the number of objective functions in the traditional problems ofMultiobjective remains unchanged, while in the proposal the model is gradually reduced. Therefore, there is a lot of limitation to take the problem of generating test data such as multi -objective optimization. multi -objective. We consider the problem of generating trial data for the coverage of routes as a uniform problem, in which each optimization problem corresponding to an objective route is a subproblem. We solve all subproblems at the same time. Therefore, the problem corresponding to the generation of test data for the coverage of multiple routes can be described as follows: this model includes subproblems, each of which is a minimization problem, and all objective functions have The same domain. We will look for an algorithm to solve these problems simultaneously, instead of solving them independently. Then, the problem (8) differs strictly from (6) and (7), and we must look for an adequate one to solve it. GA multipopulation for the generation of proof data of multiple routes in this section we will give a ga multipopulation to solve the problem (8), which is different from the traditional multipurpose gas. The main objective of our strategy is to expand the range of bays of each population through individual exchange, in order to improve the efficiency of algorith. 4.1. The initialization of populations for the OH optimization problem, randomly generating a subpopulation of size, that is, where it refers to individual TH in the population of the first generation. An individual corresponds to a chain by adequate coding. The size of the population can have some influence on the performance of the algorithms, but this is not a focus of this study, so we only give it an appropriate value. Genéic operations A technical ga, our world includes mainly three types of operations, that is, the selection, the crossover and the mutation. Individuals are selected according to their physical status, so good gens have more opportunities to copy to the next generation. the objective function as the ability of the individual. Because what we are solving are minimization problems, how much small is the aptitude of an individual, we better consider it. Crossing operation exchanges parts of two gene chains in a The probability of producing two new chromosomes, while mutation operation modifies some of the genes in a chain, resulting in a new chromosome. The crossing and mutation rates are denoted and, respectively. Because the configuration of the parameters is not the focus of this work, we only give the value of the based on the based â € ‹â €‹ in the experience. Each subpopulation implements these operations independently. In this way, the individuals of the generation TH develop to the generation TH, which can be shown as Figure 2.4.3. Individual sharing between different subpopulations The greatest difference between traditional multipopulation gas and the proposed one is found in the following Travã © s of the individual exchange between subpopulations. Specifically, every time the evolutionary operations of a generation finish, the algorithm not only determines whether an individual is a separate solution of the subpopulation to which it belongs, but also does so for the other subpopulations. In this way, people in a subpopulation are shared by all subpopulations, and the probability of finding ungeimal solutions increases significantly. The implementation of individual exchange is shown as Figure 3. because if and only if the route crossed is fair, we determine if it is a desired test data that covers according to the value of. Suppose there are target routes. In our algorithm, we can obtain the values of in an execution of the program instrumented with entry. Therefore, individual exchange can be done with the complexity of the cārculus that does not increase too much. 4.4. The steps of the algoritco based â € ‹â €‹ In the previous discussion, the main steps proposed algorithm is shown as follows. Step 1. set the values of the number of subpopulations, maximum end generation, crossing probability and mutation mutation , , where is equal to the number of target paths.Step 2. Suppose that the set of target paths is . For , randomly generate a subpopulation , . The value of generation .Step 3. For subpopulation in the th generation, calculate the values of for individual to all target paths and those of for individual to path , , .Step 4. is used as the fitness of individual for subpopulation to guide the evolution.Step 5. If there is a , which means that covers , then is an optimal solution of the th optimization subproblem. In this case, save , delete from the target path set, and terminate the evolution of the th subpopulation.Step 6. If the number of subpopulations becomes 0, or the number of generations is larger than , then stop the evolution and output the test data; otherwise, go to Step 7.Step 7. Perform genetic operations on to generate offspring population . let and go to Step 3.5. Performance Analysis We will illustrate the performance of the proposed algorithm by analyzing its efficiency and computational complexity.5.1. Efficiency of AlgorithmSuppose that the set of target paths is and is the subpopulation used to optimize the th subproblem, which is related to the problem of generating test data for . Let be the number of generations in which the th subpopulation finds the test datum covering path ; thus is a random variable. From experiences, we can suppose that . Let , , be the number of generations in which the th subpopulation finds the test datum covering ; then is also a random variable. Suppose that the probability of finding the test datum that covers is ; then , . For convenience to illustration, we also denote by .If we use traditional single-objective GAs to solve (3), in the circumstance of using the same population size, the probability of finding an optimal solution within generations is , where is the distribution function of standard normal distribution. Thus the probability of all subpopulations finding eht htiw ,revoerom ;sAG evitcejbo-elgnis lanoitidart naht tneiciffe erom si mhtirogla desoporp eht taht etanimulli yllufecrof stluser evoba ehT .sAG evitcejbo-elgnis lanoitidart fo esoht semit dna era hcihw ,ylevitcepser ,2813.0 dna 5120.0 era mhtirogla desoporp eht gnisu snoitareneg 006 dna 005 nihtiw snoitulos lamitpo lla gnidnif fo seitilibaborp eht ,shtap tegrat 5 htiw ecnatsmucric ni ,stluser eseht morf nees eb nac sA .ylevitcepser era mhtirogla desoporp eht gnisu snoitareneg 006 dna 005 nihtiw snoitulos lamitpo lla gnidnif fo seitilibaborp eht saerehw ,ylevitcepser era sAG evitcejbo-elgnis lanoitidart gnisu snoitareneg 006 dna 005 nihtiw snoitulos Lamitpo Lla Gnidnif Fo Seitilibaborp Et Neck,. rebmun eht fI .ylevitcepser era mhtirogla desoporp eht gnisu snoitareneg 006 dna 005 nihtiw snoitulos lamitpo lla gnidnif fo seitilibaborp eht saerehw ,ylevitcepser era sAG evitcejbo-elgnis lanoitidart gnisu snoitareneg 006 dna 005 nihtiw snoitulos lamitpo lla gnidnif fo seitilibaborp eht neht ; , , dna si shtap tegrat fo tes eht taht esoppuS.elpmaxe gniwollof eht yb dootsrednu ylisae eb osla nac hcihw ,si dohtem desoporp eht fo egatnavda eht suoivbo erom eht ,si shtap tegrat fo rebmun eht erom eht ,noitidda nI .sAG evitcejbo-elgnis lanoitidart fo taht naht regral si mhtirogla desoporp eht gnisu snoitulos lamitpo lla gnidnif fo ytilibaborp eht ,yas ot si tahT niatbo ew , ecniS si snoitareneg nihtiw snoitulos lamitpo lla gnidnif snoitalupopbus lla fo ytilibaborp eht suhT si snoitareneg nihtiw htap gnirevoc mutad tset eht gnidnif fo ytilibaborp EHT NEHT.) 6 (Evlos Ot Dohtem Desoporp Et Tpoda Ew Fi Si Snitareneg Nihtiw Snoitulos Lamitpo Lamitpo the number of target routes, the advantages become more obvious. 5.2. Computational complexity that will compare the computational complexity of our multipopulation genetic algorithm and those of the traditional ones. Suppose the trial program has executable statements and there are destination routes. The size of the population is. Because it can be established manually, we consider it a constant. We take the number of statements executed for the calculation of the individual aptitude and the individual exchange in a generation as a measure of the computer complexity of a Algorith. Subpopulations, then the program under test will run in times, which is equal to the number of all individuals. Since each programme execution is likely to carry out statements, the number of statements made for the implementation of the programme under test will be. Taking the calculation of fitness as a statement, then all these people need to execute statements. Therefore, the number of statements executed in a generation using traditional multipopulation gas is. If we use the proposed method to solve the problem, which means that subpopulations share all individuals, in addition to the execution of the program under test and the calculation of the aptitude of Function, we consider the calculation due to the individual exchange between subpopulations. Taking the calculation of the level of focus as a statement, the individual exchange must execute sentences. So, the number of sentences executed in a generation using the proposed method is. In normal circumstances, it's much smaller than, then. Thus, on the other hand, each subpopulation has individuals as possible solutions for each generation in the traditional multipopulation gas. But in our method, possible solutions become for each generation throughindividual, which is the traditional methods. 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In addition, if we choose the unfeasible routes as objectives, the performance of different more than all will not be distinguished, because it is impossible for any world to generate test data that cover the unfeasible routes. The prediction of the unfeasibility of a program of the program is an indecidible problem, and heurisical techniques can be used that automatically select probable routes [32] .6.2. The experimental design,

when describing the experiment, we especially care two problems that can be described as follows. Proposition 1. Can individual exchange improve the efficiency of the algorithm? To verify the first proposal, we carry out two groups of experiments. In the first group of experiments, we use GA multipurpose proposed with individual exchange to generate test data, while in the second, different populations do not implement individual exchange, but evolve independently. Proposition 2. How is the general performance of all proposed? To validate the general performance of the world proposed in this study (to abbreviate, our world), we compare it with three other more than all, the world of Gong [30], the world of Ahmed [29] [29] and all random. The reason why we adopt the all of Gong and Ahmed to compare is that it is also the problem of generating test data for multiple routes. In addition, everything random is a basic test technique and has been widely used, so we also adopt it as an object of consultation. All all of them (except one random) apply the same parameter values, which are listed in Table 4. There are two termination criteria: one is that the test data for all objective routes have been found; The other is that the number of generations has reached the maximum. 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The longer consumption of the method applied by individual exchange is 183.53 seconds (bar code), while the second method method## ### gnit si################################## ##It can be seen in Table 7 that, for all programs of subjects, the average time consumption used by our method is less than that of Gong's random methods. The shortest time of our method is 5.85 seconds (bubble classification), while Gong, Ahmed, and random methods for the same program are 8.79, 9.85 and 12.32 seconds respectively. The greatest time consumption of our method is 192.82 seconds (bar code), while Gong, Ahmed, and random methods are 224.87, 289.67 and 316.42 seconds respectively. Gong and Ahmed's methods have better results than the random method, but they're all poorer than ours. The values of and are all less than. The values of all are less than three programs, that is, Comn, Splinge and PrintTok. For these three programs, the consumption of time of our method remains less than that of the Gong method. Then we conclude that the time consumption used by our method is significantly lower than that used by Gong, Ahmed and random methods. Threats to validity This study focuses on generating test data for multiple routes coverage. A possible threat to the validity of the proposed method may be related to the configuration of the parameters. The configuration of GAS parameters influences the performance of generating test data. Appropriate options for these values can improve the performance of an algorithm and thus improve its efficiency in the generation of test data. However, how to set the appropriate parameters is not the emphasis of this study; therefore, we only give the values of the parameters based on our experience. The second threat to validity may be related to the use of software systems. Therefore, possible errors or errors, different program conversionsTest goals can also have influence on the results obtained. In addition, the selection of target routes may also have influenced the results obtained. 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