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NEC Vector Annealing Service 2.0 User‘s Guide

Third edition 2023/10

Foreword

- This user’s guide explains the initial setting and usage of NEC Vector Annealing Service 2.0.

- Remark about Trademarks and Copyrights
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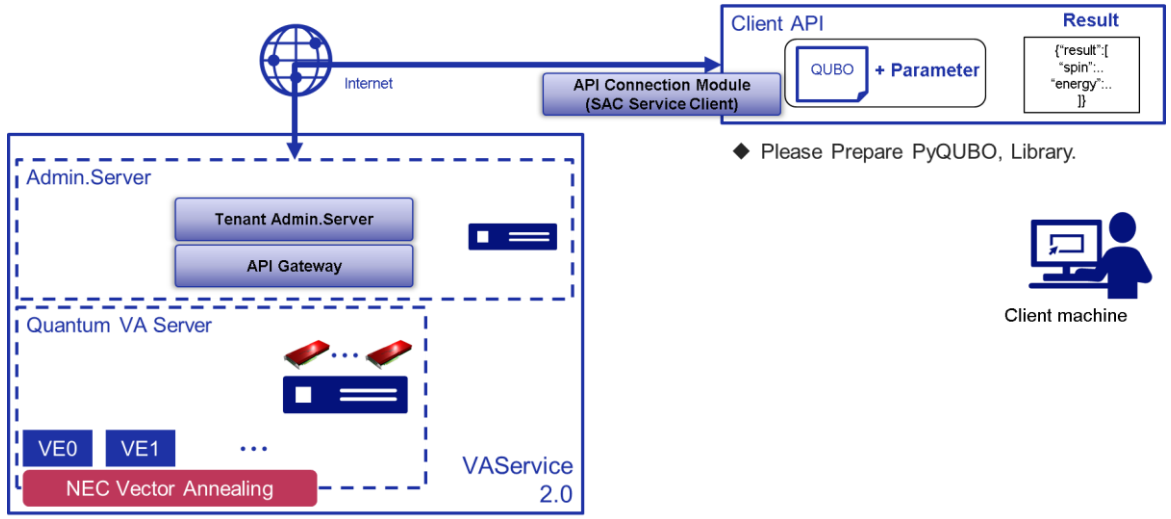
1.NEC Vector Annealing service 2.0

- NEC Vector Annealing service 2.0 is the cloud service of Vector Annealing software, which NEC researched and developed with incorporating suitable proprietary algorithm for annealing processing, on NEC's vector supercomputer "SX-Aurora TSUBASA".

- This algorithm can solve combinatorial optimization problems efficiently by utilizing various constraints imposed in practical situations and by narrowing the search range of solutions.

- This makes it possible to achieve ultra-high-speed processing of large-scale combinatorial optimization problems by performing matrix calculations on "SX-Aurora TSUBASA" with large memory



2.Initial set up

◆ Preparation

Please prepare the following in advance for connection.

- Internet environment
- Connection terminal (WindowsorLinux)
- Email address for account registration(For each person in charge)
- Python3.8
- PyQUBO　Library to convert Formulated combinatorial optimal problem into QUBO input file. The user uploads QUBO input file converted by PyQUBO.

※ It is possible to calculate the QUBO input file generated only by PyQUBO or numpy in NEC's Vector Annealing cloud service.

2.Initial set up

Flow of use

(1) NEC registers the account information (e-mail address) described in the application form.
(2) NEC inform the user of tenant ID, user ID, temporary password, and URL information for official password registration by email.
(3) User registers official password in URL.
(4) User installs SAC Service Client, which NEC provides, in user’s environment
(5) User generates QUBO input file Annealing in the customer's environment.
NEC recommends that User should use PyQUBO to generate QUOBO input file for Vector Annealing.
(6) User logs into NEC’s Vector Annealing Cloud Service with user ID and official password, and send QUBO input file.
(7) User receives the output file from NEC’s Vector Annealing Cloud Service and checks the results.

2.Initial set up

◆ Install SAC Service Client

(1) Install whlFile (sacservice-2.0.2-py3-none-any.whl) to the user’s environment which Python3.8 is installed.
(2) Execute the following
pip install sacservice-2.0.2-py3-none-any.whl

◆ Verifying the Installation

① Execute the following in your environment with Python3.8
pip freeze
② Check if "sacservice“ exists in the output package.
if it exists, the installation is completed without problems.

3. API Access Information

3-1.APIlist

API	Usage
init_sac( )	initialization process (including Login)
solve_qubo ( )	Calculation execution

Sample image

```
1 from SACService import SACServiceClient
2 # Object Creation
3 sac = SACServiceClient()
4 # Initialization process
5 init_param = {
6   'user_id': 'test_user',
7   'password': 'abcdefg'
8 }
9
10 sac.init_sac(init_param)
11 # Calculation execution
12 solve_param = {
13  'offset': 0,
14   'num_reads': 1,
15   'timeout': 100
16 }
17 result = sac.solve_qubo(qubo, solve_param)
18 print(result)
```

3. API Access Information

3-2.parameter

3-2-1 Parameter of init_param

Name	type	explanation	Required
userId	**str**	**USERID**	**Yes**
password	**str**	**PASSWORD**	**Yes**
proxy	**str**	**PROXY**	**-**
api_url	**str**	**Access URL**	**-**

3. API Access Information

3-2-2 Parameter of solve_param

Required parameters

No	Entry item	Type	Description	Required	Default	Single*/MPI	Configurable value *Just enterable value for reference
1	offset	float	Offset for the normalized weight information stored in the qubo	Yes	-	Common	Between -3.402823E+38 and 3.402823E+38

Optional parameters

No	Entry item	Type	Description	Required	Default	Single*/MPI	Configurable value *Just enterable value for reference
1	num_reads	int	VA sampling rate	-	1	Common	Between 1 and 20
2	num_results	int	Number of VA annealing results	-	1	Common	Returns only the optimal solution when 1 or None is specified. Returns all results when the same value as num_reads is specified.
3	num_sweeps	int	Number of VA annealing sweeps	-	500	Common	Between 1 and 100000
4	beta_range	[float, float, int]	VA beta value [start, end, steps] format	-	[10.0, 100.0, 200]	Common	start Between 1.1754945E-38 and 3.402823E+38 or end or less end: Between 1.1754945E-38 and 3.402823E+38 or start or more steps: Between 1 and 100000

3. API Access Information

3-2-2 Parameter of solve_param

Optional parameters

No	Entry item	Type	Description	Required	Default	Single/MPI	Configurable value *Just enterable value for reference
5	beta_list	[float, float,..]	Beta value array for each VA sweep	-	-	Common	Between 1.1754945E-38 and 3.402823E+38
6	dense	bool	VA matrix mode	-	None	Common	True: dense matrix mode False: operates in sparse matrix mode. None: automatic selection according to the QUBO density.
7	vector_mode	str	Mode during VA annealing	-	accuracy	Single	speed/accuracy speed: annealing in speed priority mode. accuracy: annealing in accuracy priority mode.
8	timeout	int	Job execution timeout value Set the waiting time limit (*) to wait until the completion of annealing ,if necessary.	-	1800	Common	Standard：Between 1 and 7200 Professional：0

3. API Access Information

3-2-2 Parameters of solve_param

Optional Parameters

No	Item	Type	Description	Required	Single/MPI	Setting example
9	Ve_num	Int	Number of VEs used in VA annealing	1	MPI	Between 1 and the number of VEs installed on each server.
10	onehot	list	VA onehot constraint parameter	-	Common	[[“x[0]”, “x[1]”], [“x[2]”, “x[3]”],..]
11	fixed	list/dict	VA fixed constraint parameter	-	Common	{“x[0]”: 1, “x[1]”: 0,..} [[“x[0]”:1], [“x[1]”, 0],..]
12	andzero	list	VA andzero constraint parameter	-	Common	[[“x[0]”, “x[1]”], [“x[2]”, “x[3]”],..]
13	orone	list	VA orone constraint parameter	-	Common	[[“x[0]”, “x[1]”], [“x[2]”, “x[3]”],..]
14	supplement	list	VA supplement constraint parameter	-	Common	[[“y[0]”, “x[0]”, “x[1]”], [“y[1]”, “x[0]”, “x[1]”],..]
15	maxone	list	VA maxone constraint parameter	-	Common	[[1, [“x[0]”, “x[1]”, “x[2]”]], [2 [“x[3]”, “x[4]”, “x[5]”]]]
16	minmaxone	list	VA minmaxone constraint parameter	-	Common	[[1, 2, [“x[0]”, “x[1]”, “x[2]”]], [2 3,[“x[3]”, “x[4]”, “x[5]”, “x[6]”]]]
17	init_spin	list/dict	VA init_spin parameter	-	Common	{“x[0]”: 1, “x[1]”: 0,..} [[“x[0]”:1], [“x[1]”, 0]]
18	spin_list	list	VA spin_list parameter	-	Common	[“x[0]”, “x[1]”, “x[2]”,..]

※

※ For details, see 4.How to use the flip option”

3. API Access Information

3-3.response

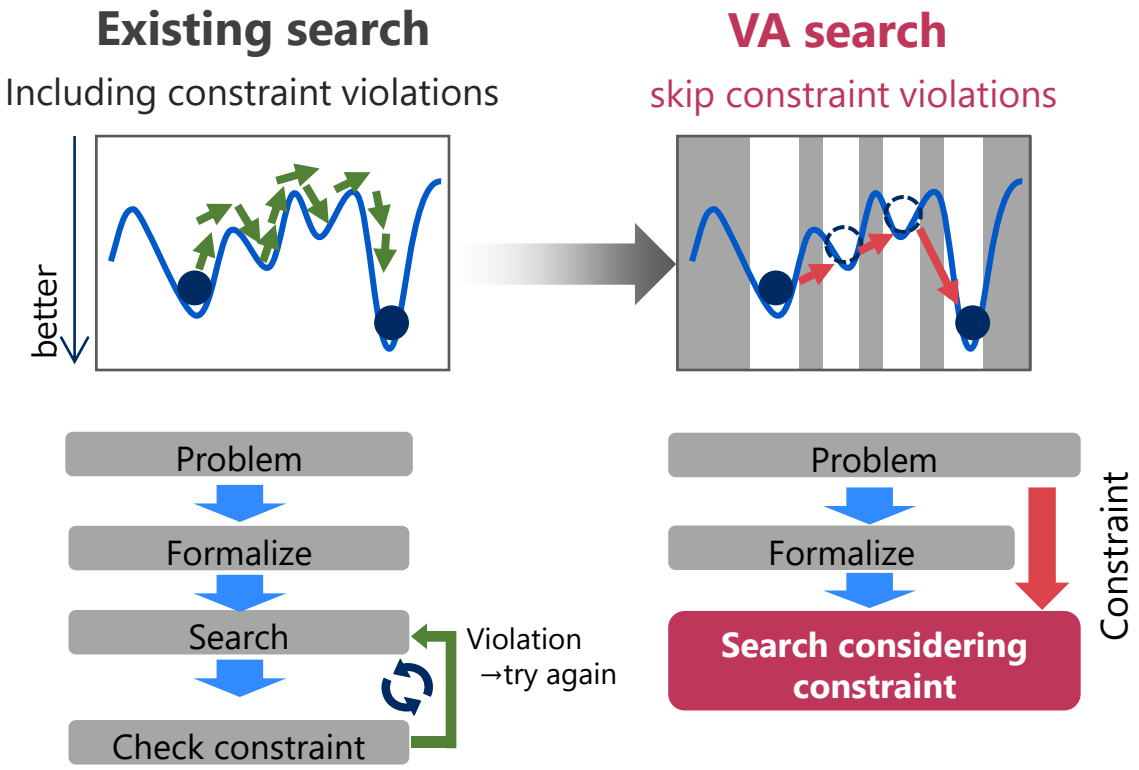
Name	type	explanation	value
result	**list**	**Indicates the return value of the execution result. Returns a list of one or more dicts containing the following items:**	**dict list containing constraint /energy/ memory_usage/ spin/ time**

Item	Description	Type	Supplement
constraint	Spin constraint satisfaction state	bool	-
energy	Energy value	float	-
memory_usage	VA memory usage	float	Output in unit of GiB
spin	Spin result	dict {“Spin name”: spin state}	-
time	VA operation time	float	Output in unit of seconds

4.How to use the flip option

What is the Flip Option

- A function that can reduce the amount of computation by searching only solution spaces that satisfy constraints
  - Example: In case the constraint is only one becomes 1 out of x1～x10 spin of (0/1).
    Even if the spin is reversed during searching, x1～x10 is inverted to satisfy the above constraints.



4. How to use Flip Option (1/8)

- By specifying Flip option, you can efficiently obtain the results in a simulation.

*These options must be included in Hamiltonian's formulation.

- Sample code: Traveling salesman problem

```
# create one hot constraint rule.
onehot = [0] * (2 * point_num)
for i in range(point_num):
    onehot1 = [0] * point_num
    onehot2 = [0] * point_num
    for j in range(point_num):
        onehot1[j] = 'x[%d][%d]' % (i, j)
        onehot2[j] = 'x[%d][%d]' % (j, i)
    onehot[2*i  ] = onehot1
    onehot[2*i+1] = onehot2

# create fixed spin constraint rule.
fixed = []
for i in range(point_num):
    for j in range(point_num):
        if (j == 0) and (i == 0):
            fixed.append(['x[0][0]', 1])
        elif (j != 0) and (i == 0):
            fixed.append(['x[0][%d]' % j, 0])
        elif (j == 0) and (i != 0):
            fixed.append(['x[%d][0]' % i, 0])

solve_param = { 'offset': offset, 'onehot': onehot, 'fixed': fixed }
```

Define constraints on Onehot

Specify the constraint so that only one city becomes 1 at order i and only one order becomes 1 at city j.

Specify x[0][0] = 1 and x[0][*] = x[*][0] = 0 in order to start from the city at j= 0

Define constraints on Fixed spin

Example of solve param

4.How to use Flip Option (2/8)

One hot constraint

- The constraint that one of the spin states is “1” in the specified group of spin

```
one_hot_list = [
  [ 'x[0][0]', 'x[0][1]',  'x[0][2]',  'x[0][3]',  'x[0][4]' ],
  [ 'x[1][0]', 'x[1][1]',  'x[1][2]',  'x[1][3]',  'x[1][4]' ],
  [ 'x[2][0]', 'x[2][1]',  'x[2][2]',  'x[2][3]',  'x[2][4]' ],
]

solve_param = { 'offset': offset, 'onehot': one_hot_list }
```

A group of One hot constraints

Define multiple one hot constraints

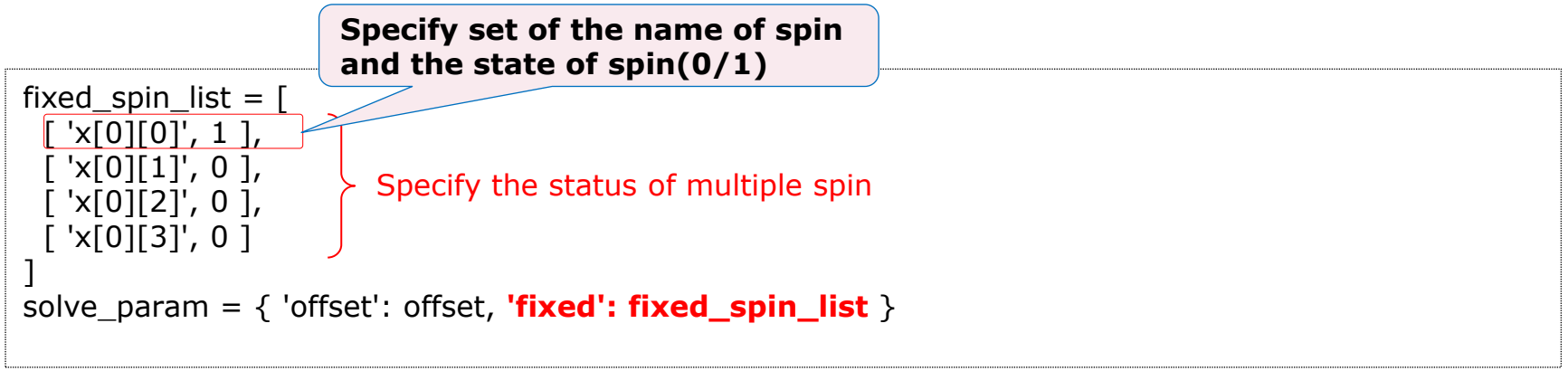
Specify the defined one hot condition in the variable of onehot

4. How to use Flip Option (3/8)

◆ Fixed spin constraint

*Only this option does not need to be included in Hamiltonian's formulation.

- The constraint that specifies the state of spin to the specified value (0/1)



4. How to use Flip Option (4/8)

And zero constraint

- The constraint that at least one of the spin states is “0” in the specified group of spin

```
and_zero_list = [
 [ 'x[0][0]', 'x[0][1]',  'x[0][2]',  'x[0][3]',  'x[0][4]' ],
  [ 'x[1][0]', 'x[1][1]',  'x[1][2]',  'x[1][3]',  'x[1][4]' ],
  [ 'x[2][0]', 'x[2][1]',  'x[2][2]',  'x[2][3]',  'x[2][4]' ],
]

solve_param = { 'offset': offset, 'andzero': and_zero_list }
```

A Group of And zero constraint

Define multiple and zero constraint

Specify the defined and zero condition in the variable of andzero

4.How to use Flip Option (5/8)

Or one constraint

- The constraint that at least one of the spin states is “1” in the specified group of spin

```
or_one_list = [
 [ 'x[0][0]', 'x[0][1]',  'x[0][2]',  'x[0][3]',  'x[0][4]' ],
  [ 'x[1][0]', 'x[1][1]',  'x[1][2]',  'x[1][3]',  'x[1][4]' ],
  [ 'x[2][0]', 'x[2][1]',  'x[2][2]',  'x[2][3]',  'x[2][4]' ],
]

solve_param = { 'offset': offset, 'orone': or_one_list }
```

A Group of Or one constraint

Define multiple or one constraint

Specify the defined or one condition in the variable of orone

4. How to use Flip Option (6/8)

◆ Cubic supplement constraint

- The constraint that spin(x_1, x_2, y_1) always has a value that satisfies expression $y_1 = x_1 x_2$

Describe the constraints of cubic supplement in the order of y_1, x_1, x_2

```
spl_list = [
  [ 'y[0]', 'x[0][0]',  'x[0][1]'],
  [ 'y[1]', 'x[1][0]',  'x[1][1]'],
  [ 'y[2]', 'x[2][0]',  'x[2][1]'],
]

solve_param = { 'offset': offset, 'supplement': spl_list }
```

Define multiple cubic supplement constraint

Specify the defined cubic supplement condition in the variable of spl

***Need the following Hamiltonian that satisfied expression $y_1 = x_1 x_2$**

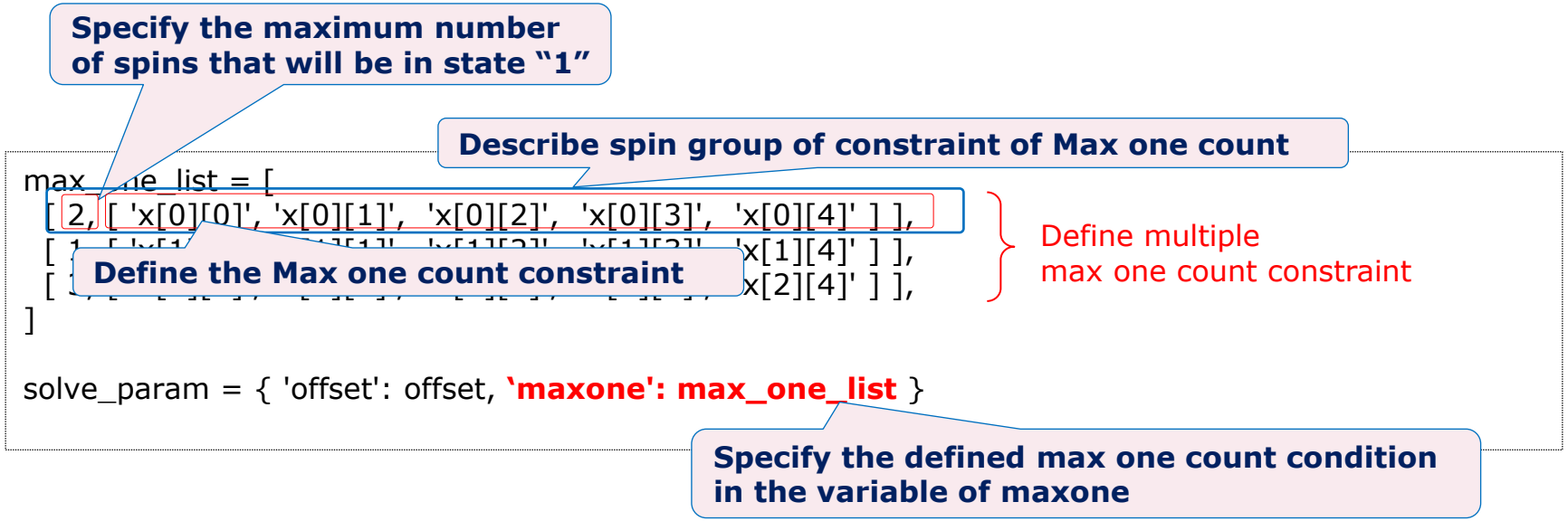
Hamiltonian formulation sample)

```
Hp1 = x[0,0]*x[0,1]-2*x[0,0]*y[0]-2*x[0,1]*y[0]+3*y[0]
Hp2 = x[1,0]*x[1,1]-2*x[1,0]*y[1]-2*x[1,1]*y[1]+3*y[1]
Hp3 = x[2,0]*x[2,1]-2*x[2,0]*y[2]-2*x[2,1]*y[2]+3*y[2]
```

4.How to use Flip Option (7/8)

Max one count constraint

- The constraint that the number of spins having the “1” state in the specified group is equal to or less than the specified number.



4.How to use Flip Option (8/8)

◆ Min max one constraint

- The constraint that the number of spins having the “1” state in the specified group is equal to the specified range.
  - The range parameter is defined as [MIN, MAX, [spin0, spin1, spin2, ...]]

    In the case of MIN =< MAX
    MIN =< the number of spins having the “1” state =< MAX

    In the case of MIN > MAX
    the number of spins having the “1” state =< MAX or MIN =< the number of spins having the “1” state

```
minmax_one_list = [
  [ 1, 3, [ 'x[0][0]', 'x[0][1]',  'x[0][2]',  'x[0][3]',  'x[0][4]' ] ],
  [ 3, 1, [ 'x[1][0]', 'x[1][1]',  'x[1][2]',  'x[1][3]',  'x[1][4]' ] ],
  [ 2, 3, [ 'x[2][0]', 'x[2][1]',  'x[2][2]',  'x[2][3]',  'x[2][4]' ] ],
]

solve_param = { 'offset': offset, 'minmaxone': minmax_one_list }
```

Specify MIN=1 (Minimum threshold)

Describe spin group of constraint of Min max one

Specify MAX=3 (Maximum threshold)

Define the Min max one constraint

the number of spins having the “1” state =< MAX(=1) or MIN(=3) =< the number of spins having the “1” state

Define multiple min max one constraint

How to specify the initial spin state

How to specify the initial spin state

- You can specify the spin state when annealing starts in the following two ways
  - Specify “Fixed spin” constraint for the model
    - Because “Fixed spin” constraint is the constrained condition that specifies the spin being a fixation, it is possible to apply the state of the specified spin to the initial spin state.
  - Specify the initial spin state at the call of the annealing
- Action
  - specify the initial spin state to the initial value when annealing starts
  - If you specify a different value for the same spin, set the value with the following priority

1. The condition specified “Fixed spin” constraint for the model
2. The condition specified the initial spin state at the call of the annealing

Sample code:

```
spin_state = {
 'x[0][0]':0,
 'x[1][1]':1,
 'x[2][3]':1,
  …
}

solve_param = { 'offset': offset, 'num_reads': 5, 'init_spin': spin_state }
```

Initial spin state is specified by a combination of spin name and spin state (0/1). Spins that are not included are treated as no initial value, and the initial value is determined by a random spin state at the start of the annealing.

Specify the dictionary type data which stores the initial value of the spin for init_spin.

5.List of error codes

Error code	Error message
S100	queryStringParameters is missing
S101	user_id is missing
S102	password is missing
S103	authentication error.
S104	authentication error.
S105	body is missing
S106	qubo_size is missing
S107	offset is missing
S108	authentication error.
S109	body is missing
S110	requestId is missing
S111	authentication error.
S112	requestId is not exist
S113	authentication error.
S114	authentication error.
S115	body is missing
S116	requestId is missing
S117	requestId is not exist
S118	Authorization is missing
S119	refresh-token is missing

Error code	Error message
S120	authentication error.
S121	authentication error.
S122	body is missing
S123	requestId is missing
S124	authentication error.
S125	body is missing
S126	requestId is missing
S127	authentication error.
S128	authentication error.
S129	body is missing
S130	requestId is missing
S131	authentication error.
S200	offset is not of type float. value = ※variable
S201	qubo_size is not of type int. value = ※variable
S202	num_reads is not of type int. value = ※variable
S203	num_results is not of type int. value = ※variable
S204	num_sweeps is not of type int. value = ※variable
S205	bata_range is not of type list. value = ※variable
S206	beta_range[0] is not of type float. value = ※variable
S207	beta_range[1] is not of type float. value = ※variable

5.List of error codes

Error code	Error message
S208	beta_range[2] is not of type int. value = ※variable
S209	beta_list is not of type list. value = ※variable
S210	beta_list[※variable] is not of type int. value = ※variable
S211	vector_mode is not of type str. value = ※variable
S212	timeout is not of type int. value = ※variable
S213	ve_num is not of type int. value = ※variable
S214	onehot is not of type list. value = ※variable
S215	fixed is not of type list. value = ※variable
S216	andzero is not of type list. value = ※variable
S217	orone is not of type list. value = ※variable
S218	supplement is not of type list. value = ※variable
S219	maxone is not of type list. value = ※variable
S220	minmaxone is not of type list. value = ※variable
S221	init_spin is not of type list. value = ※variable
S222	spin_list is not of type list. value = ※variable
S300	offset is overflow. Must be set to 3.402823E+38 or below.
S300	offset is underflow. Must be set to -3.402823E+38 or above.
S301	qubo_size is overflow. Must be set to ※variable or below.
S301	qubo_size is underflow. Must be set to 0 or above.

Error code	Error message
S302	num_reads is overflow. Must be set to 20 or below.
S302	num_reads is underflow. Must be set to 1 or above.
S303	num_results is overflow. Must be set to 20 or below.
S303	num_results is underflow. Must be set to 1 or above.
S304	num_sweeps is overflow. Must be set to 100000 or below.
S304	num_sweeps is underflow. Must be set to 1 or above.
S305	number of elements in beta_range is not 3. The number of elements must be set to 3.
S306	beta_range[0] is overflow. Must be set to ※variable or below.
S306	beta_range[0] is underflow. Must be set to 1.1754945E-38 or above.
S307	beta_range[1] is overflow. Must be set to 3.402823E+38 or below.
S307	beta_range[1] is underflow. Must be set to 1.1754945E-38 or above.
S308	beta_range[2] is overflow. Must be set to 100000 or below.
S308	beta_range[2] is underflow. Must be set to 1 or above.
S309	beta_list[※variable] is overflow. Must be set to 3.402823E+38 or below.
S309	beta_list[※variable] is underflow. Must be set to 1.1754945E-38 or above.

5.List of error codes

Error code	Error message
S310	dense is invalid. Must be set to True or False or None.
S311	vector_mode is invalid. Must be set to speed or accuracy.
S312	timeout is invalid. Must be set to 0
S313	timeout is overflow. Must be set to 7200 or below.
S313	timeout is underflow. Must be set to 1 or above.
S314	ve_num is overflow. Must be set to 8 or below.
S314	ve_num is underflow. Must be set to 1 or above.
S315	ve_num is overflow. Must be set to 1.
S316	ve_num exceeds number of contracts. Must be set to number of contract or below.
S317	ve_num is overflow. Must be set to ※可変 or below.
S318	ve_num exceeds number of contracts. Must be set to number of contract or below.
E300	The onehot flip option you entered is not a list type.
E301	The group for the onehot flip option you entered is not a list type.
E302	The spin name for the onehot flip option you entered is not str type.
E303	The fixed flip option you entered is not a list type or a dict type.

Error code	Error message
E304	The spin name of the dict type fixed flip option you entered is not a str type.
E305	The spin state of the dict type fixed flip option you entered is not an int type.
E307	The spin name of the list type fixed flip option you entered is not a str type.
E308	The spin state of the list type fixed flip option you entered is not an int type.
E309	The andzero flip option you entered is not a list type.
E310	The group for the andzero flip option you entered is not a list type.
E311	The spin name for the andzero flip option you entered is not str type.
E312	The orone flip option you entered is not a list type.
E313	The group for the orone flip option you entered is not a list type.
E314	The spin name for the orone flip option you entered is not str type.
E315	The supplement flip option you entered is not a list type.
E316	The group for the supplement flip option you entered is not a list type.
E317	The spin name for the supplement flip option you entered is not str type.

5.List of error codes

Error code	Error message
E318	The number of spins set for the supplement flip option is not 3.
E319	The maxone flip option you entered is not a list type.
E320	The group for the maxone flip option you entered is not a list type.
E321	The number of elements in the maxone flip option group is invalid.
E322	The threshold for the maxone flip option you entered is not int type.
E323	The spin group for the maxone flip option you entered is not a list type.
E324	The spin name for the maxone flip option you entered is not a str type.
E325	The number of thresholds for the maxone flip option is invaild.
E326	The minmaxone flip option you entered is not a list type.
E327	The group for the minmaxone flip option you entered is not a list type.
E328	The number of elements in the minmaxone flip option group is invalid.
E329	The min threshold for the minmaxone flip option you entered is not int type.
E330	The max threshold for the minmaxone flip option you entered is not int type.

Error code	Error message
E331	The spin group for the minmaxone flip option you entered is not a list type.
E332	The spin name for the minmaxone flip option you entered is not a str type.
E333	The init_spin parameter you entered is not a list type or a dict type.
E334	The spin name of the dict type init_spin parameter you entered is not a str type.
E335	The spin state of the dict type init_spin parameter you entered is not an int type.
E336	The spin array of the list type init_spin parameter you entered is not a list type.
E337	The spin name of the list type init_spin parameter you entered is not a str type.
E338	The spin state of the list type init_spin parameter you entered is not an int type.
E339	The spin_list parameter you entered is not a list type.
E340	The spin name of spin_list parameter you entered is not a list type or a str type.

5.List of error codes

Error code	Error message
S400	Incorrect username or password.
S401	Too many requests. Try again later.
S402	An unexpected error has occurred
S403	An unexpected error has occurred
S404	Too many requests. Try again later.
S405	Too many requests. Try again later.
S406	An unexpected error has occurred
S407	Too many requests. Try again later.
S408	An unexpected error has occurred
S409	Incorrect username or refresh_token.
S410	Too many requests. Try again later.
S411	An unexpected error has occurred
S412	Request statue is not complete.
S413	An unexpected error has occurred
S414	Too many requests. Try again later.
S415	An unexpected error has occurred
S416	An unexpected error has occurred
S417	Too many requests. Try again later.
S418	Request statue is not complete.
S419	Too many requests. Try again later.
S420	Too many requests. Try again later.
S421	Too many requests. Try again later.

Error code	Error message
S422	An unexpected error has occurred
S423	An unexpected error has occurred
S424	An unexpected error has occurred
S425	An unexpected error has occurred
S426	An unexpected error has occurred
E400	The input value of the offset parameter is out of the supported range.
E401	The input value of the num_reads parameter is out of the supported range.
E402	The input value of the num_results parameter is out of the supported range.
E403	The input value of the num_sweeps parameter is out of the supported range.
E404	The input value beta_range of start parameter is out of the supported range.
E405	The input value beta_range of end parameter is out of the supported range.
E406	The input value beta_range of steps parameter is out of the supported range.
E407	The input value beta_range start should be smaller than end.
E408	The input value beta_list of beta parameter is out of the supported range.

5.List of error codes

Error code	Error message
E409	The input value dict type init_spin_param of spin state is out of the supported range.
E410	The input value list type init_spin_param of spin state is out of the supported range.
E411	The input value nthreads parameter is out of the supported range.
S500	param_dict is None
S501	param_dict is not dict. param_dict: ※variable
S502	user_id is not contained in the parameters.
S503	password is not contained in the parameters.
S504	proxy is not in proxy format.
S505	api_url is not in URL format.
S506	qubo is None.
S507	qubo is not dict. qubo: ※variable
S508	An unexpected error has occurred. Exception: ※variable
S509	An unexpected error has occurred. Exception: ※variable RequestId: ※variable
S510	Error was returned. status: ※variable requestId: ※variable
S511	Wrong status was returned. status: ※ variable requestId: ※variable

Error code	Error message
S951	An internal error occurred before executing the calculation. Please contact your administrator.
S954	An internal error occurred before executing the calculation. Please contact your administrator.
S958	An internal error occurred before executing the calculation. Please contact your administrator.
S959	An internal error occurred before executing the calculation. Please contact your administrator.
S970	Failed to download QUBO data. Please contact your administrator.
S980	VASampler calculation execution result is an error.
S981	VASampler calculation result is empty. Please contact your administrator.
S982	An internal error occurred while processing VASampler calculation execution results. Please contact your administrator.

appendix

Uninstall SAC Service Client

- In case of cancelling NEC Vector Annealing service 2.0, please uninstall SAC Service Client

① Execute the below in the environment which SAC service client is installed.

pip uninstall sacservice

Publication history

List of Publication history

- 1st Edition :June 2023
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- 3rd Edition :October 2023

Details of additions and changes

- 1st Edition : Newly released
- 2nd Edition :Update. 4. How to use the flip option
- 3rd Edition :Corrected the description of the flip option

NEC Vector Annealing service 2.0 Userguide

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