

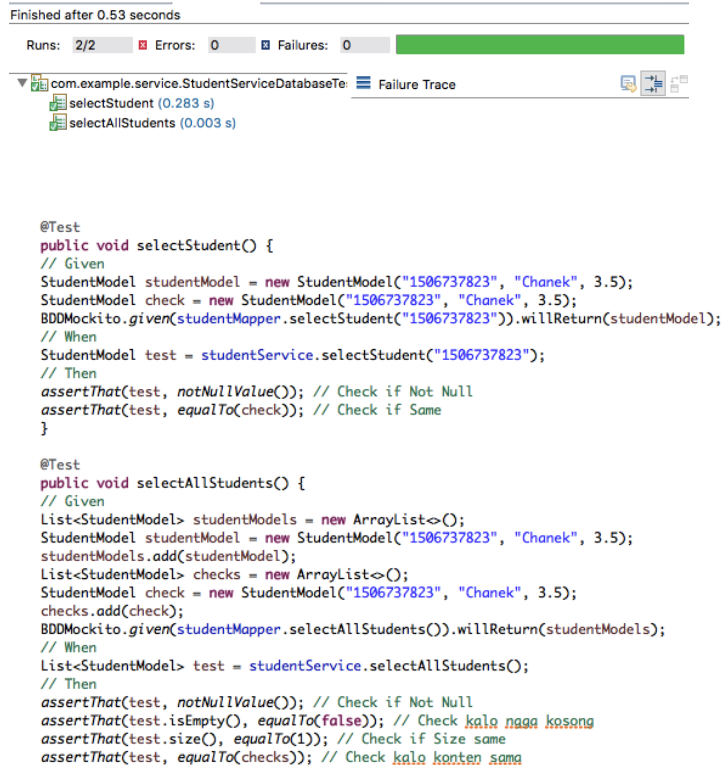
RINGKASAN

Dalam tutorial ini mempelajari mengenai *unit testing* dan load testing. *Unit testing* dilakukan dengan menggunakan Junit & Mockito. Testing tersebut dilakukan pada method-method yang sudah dibuat pada tutorial sebelumnya. Pada load testing digunakan JMeter untuk melakukan load testing. Method- method yang dilakukan testing adalah addStudent, updateStudent, deleteStudent, dan selectAllStudent.

LATIHAN UNIT TESTING

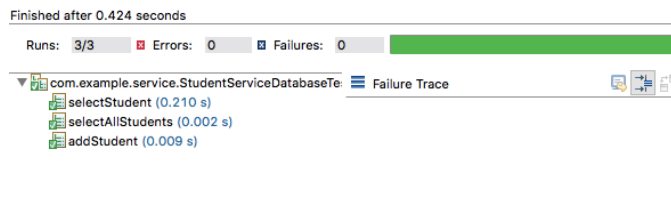
1. Tambahkan kode berikut pada StudentServiceDatabaseTest. Jelaskan pada method tersebut berikut dengan hasil testingnya!

- selectAllStudent



Gambar tersebut menjelaskan method `selectAllStudent` yang dimulai dari menginisialisasi object berupa list dengan nama `studentModel` dan `check`, kemudian Mockito akan memanipulasi fungsi `selectAllStudent` dengan return `studentModels`. Kemudian akan dilakukan testing terhadap method `selectAllStudents` selanjutnya akan dilakukan pemeriksaan jika tidak null/ kosong jika ukuran sama dan konten juga sama.

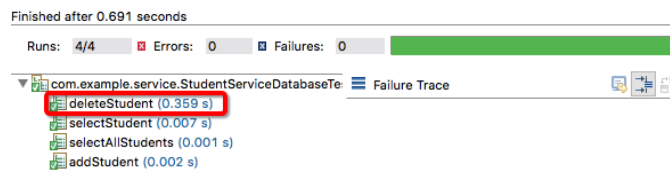
- addStudent



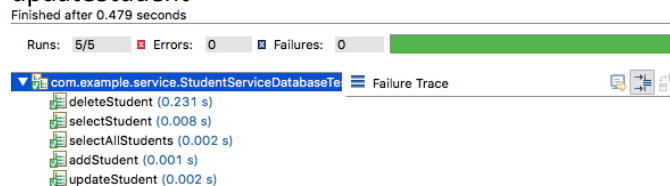
```
@Test
public void addStudent() {
    // Given
    StudentModel studentModel = new StudentModel("1506737823", "Chanek", 3.5);
    StudentModel check = new StudentModel("1506737823", "Chanek", 3.5);
    BDDMockito.given(studentService.addStudent(studentModel)).willReturn(true);
    // When
    boolean test = studentService.addStudent(studentModel);
    // Then
    BDDMockito.then(studentMapper).should().addStudent(check);
    assertThat(test, equalTo(true)); // Check if Same
}
```

Dalam method tersebut menjelaskan tentang method addStudent dimana pertama kali dibuat object StudentModel yang diisi dengan data student. Selanjutnya dibuatlah object dengan nama check yang akan diisi oleh data student, selanjutnya akan dipanggil method AddStudent pada studentService yang akan mengembalikan nilai true. Selanjutnya Mockito akan memeriksa nilai dari test apakah bernilai true atau false.

- deleteStudent



- updateStudent



LATIHAN LOAD TESTING

Screenshoot hasil JMeter fitur soal latihan load testing nomor 1 sebelum dioptimasi. Optimalisasi tidak dapat dilakukan karena kode tersebut dirasa sudah paling optimal. Karena query yang digunakan langsung menunjuk pada kolom nama dan gpa pada tabel student.

- **jmeter_selectStudentBerhasil**

Gambar berikut merupakan pengaturan dari Thread Group dan hasil dari load testing yang dijalankan yang dilakukan untuk melakukan Load Testing dengan menggunakan JMeter untuk selectStudentBerhasil.

HTTP Request

Name: HTTP Request

Comments:

Basic Advanced

Web Server

Protocol [http]: Server Name or IP: localhost Port Number: 8080

HTTP Request

Method: GET Path: student/view/1506737826 Content encoding:

☐ Redirect Automatically ☒ Follow Redirects ☒ Use KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

Parameters Body Data Files Upload

Send Parameters With the Request:

Name:	Value	Encode?	Include Equals?
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Berikut merupakan hasil dari load testing selectStudentBerhasil (npm student ditemukan)

Sample #	Start Time	Thread Name	Label	Sample Time(ms)	Status	Bytes	Sent Bytes	Latency	Connect Time(ms)
63	16:21:12.671	Thread Group ...	HTTP Request	11	200	1554	137	11	1
64	16:21:12.775	Thread Group ...	HTTP Request	11	200	1554	137	11	1
65	16:21:12.871	Thread Group ...	HTTP Request	10	200	1554	137	10	0
66	16:21:12.972	Thread Group ...	HTTP Request	11	200	1554	137	11	1
67	16:21:13.076	Thread Group ...	HTTP Request	11	200	1554	137	11	1
68	16:21:13.173	Thread Group ...	HTTP Request	10	200	1554	137	10	1
69	16:21:13.271	Thread Group ...	HTTP Request	10	200	1554	137	10	1
70	16:21:13.376	Thread Group ...	HTTP Request	11	200	1554	137	11	1
71	16:21:13.475	Thread Group ...	HTTP Request	13	200	1554	137	13	3
72	16:21:13.578	Thread Group ...	HTTP Request	10	200	1554	137	10	1
73	16:21:13.678	Thread Group ...	HTTP Request	11	200	1554	137	11	1
74	16:21:13.778	Thread Group ...	HTTP Request	10	200	1554	137	10	1
75	16:21:13.878	Thread Group ...	HTTP Request	10	200	1554	137	10	1
76	16:21:13.976	Thread Group ...	HTTP Request	16	200	1554	137	16	2
77	16:21:14.074	Thread Group ...	HTTP Request	7	200	1554	137	7	0
78	16:21:14.175	Thread Group ...	HTTP Request	10	200	1554	137	10	1
79	16:21:14.276	Thread Group ...	HTTP Request	12	200	1554	137	12	1
80	16:21:14.379	Thread Group ...	HTTP Request	13	200	1554	137	13	1
81	16:21:14.475	Thread Group ...	HTTP Request	19	200	1554	137	19	1
82	16:21:14.579	Thread Group ...	HTTP Request	11	200	1554	137	11	1
83	16:21:14.676	Thread Group ...	HTTP Request	11	200	1554	137	10	1
84	16:21:14.780	Thread Group ...	HTTP Request	12	200	1554	137	12	1
85	16:21:14.878	Thread Group ...	HTTP Request	13	200	1554	137	13	1
86	16:21:14.975	Thread Group ...	HTTP Request	14	200	1554	137	14	2
87	16:21:15.080	Thread Group ...	HTTP Request	10	200	1554	137	10	1
88	16:21:15.181	Thread Group ...	HTTP Request	11	200	1554	137	11	1
89	16:21:15.281	Thread Group ...	HTTP Request	9	200	1554	137	9	1
90	16:21:15.381	Thread Group ...	HTTP Request	10	200	1554	137	10	1
91	16:21:15.478	Thread Group ...	HTTP Request	18	200	1554	137	18	1
92	16:21:15.581	Thread Group ...	HTTP Request	12	200	1554	137	12	1
93	16:21:15.682	Thread Group ...	HTTP Request	10	200	1554	137	10	1
94	16:21:15.782	Thread Group ...	HTTP Request	11	200	1554	137	11	1
95	16:21:15.882	Thread Group ...	HTTP Request	9	200	1554	137	9	1
96	16:21:15.982	Thread Group ...	HTTP Request	17	200	1554	137	17	2
97	16:21:16.082	Thread Group ...	HTTP Request	9	200	1554	137	9	1
98	16:21:16.182	Thread Group ...	HTTP Request	10	200	1554	137	10	1
99	16:21:16.279	Thread Group ...	HTTP Request	9	200	1554	137	9	1
100	16:21:16.384	Thread Group ...	HTTP Request	9	200	1554	137	9	0

☐ Scroll automatically? ☐ Child samples? No of Samples 100 Latest Sample 9 Average 11 Deviation 3

- **jmeter_selectStudentGagal**

Berikut merupakan gambar untuk screenshoot pengaturan pada Thread Group dan hasil untuk load testing selectStudentGagal.

HTTP Request

Name: HTTP Request

Comments:

Basic Advanced

Web Server

Protocol [http]: Server Name or IP: localhost Port Number: 8080

HTTP Request

Method: GET Path: student/view/1506737800 Content encoding:

☐ Redirect Automatically ☒ Follow Redirects ☒ Use KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

Parameters Body Data Files Upload

Send Parameters With the Request:

Name:	Value	Encode?	Include Equals?
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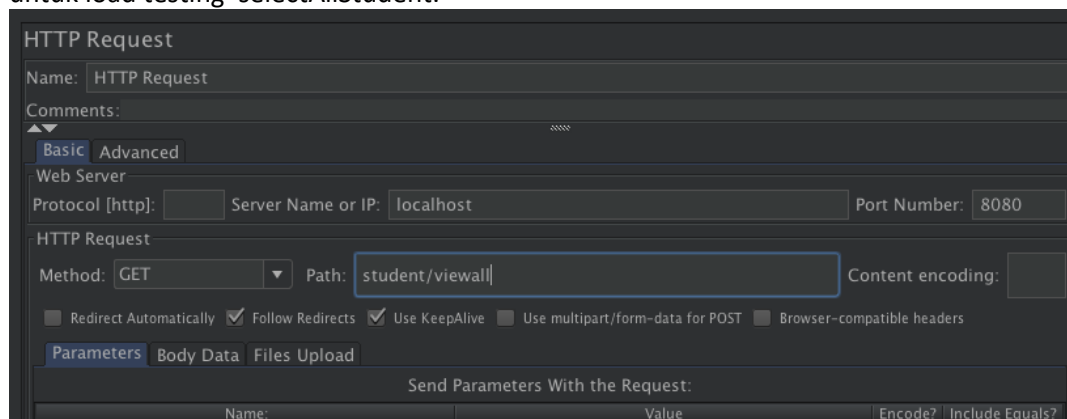
Berikut merupakan hasil dari load hasil selectStudentGagal (npm student tidak ditemukan).

Sample #	Start Time	Thread Name	Label	Sample Time(ms)	Status	Bytes	Sent Bytes	Latency	Connect Time(ms)
63	17:24:28.104	Thread Group ...	HTTP Request	12		342	137	12	2
64	17:24:28.201	Thread Group ...	HTTP Request	5		342	137	5	1
65	17:24:28.303	Thread Group ...	HTTP Request	10		342	137	10	1
66	17:24:28.403	Thread Group ...	HTTP Request	7		342	137	6	1
67	17:24:28.501	Thread Group ...	HTTP Request	6		342	137	6	2
68	17:24:28.603	Thread Group ...	HTTP Request	9		342	137	9	1
69	17:24:28.705	Thread Group ...	HTTP Request	13		342	137	13	2
70	17:24:28.800	Thread Group ...	HTTP Request	7		342	137	7	1
71	17:24:28.903	Thread Group ...	HTTP Request	7		342	137	7	1
72	17:24:29.003	Thread Group ...	HTTP Request	12		342	137	12	1
73	17:24:29.103	Thread Group ...	HTTP Request	5		342	137	5	1
74	17:24:29.203	Thread Group ...	HTTP Request	9		342	137	9	2
75	17:24:29.304	Thread Group ...	HTTP Request	8		342	137	8	2
76	17:24:29.403	Thread Group ...	HTTP Request	10		342	137	10	1
77	17:24:29.502	Thread Group ...	HTTP Request	9		342	137	9	2
78	17:24:29.602	Thread Group ...	HTTP Request	14		342	137	13	2
79	17:24:29.701	Thread Group ...	HTTP Request	8		342	137	8	1
80	17:24:29.802	Thread Group ...	HTTP Request	9		342	137	9	2
81	17:24:29.906	Thread Group ...	HTTP Request	12		342	137	11	2
82	17:24:30.004	Thread Group ...	HTTP Request	7		342	137	7	1
83	17:24:30.102	Thread Group ...	HTTP Request	8		342	137	8	2
84	17:24:30.201	Thread Group ...	HTTP Request	9		342	137	8	2
85	17:24:30.302	Thread Group ...	HTTP Request	9		342	137	9	1
86	17:24:30.408	Thread Group ...	HTTP Request	13		342	137	12	3
87	17:24:30.506	Thread Group ...	HTTP Request	6		342	137	6	1
88	17:24:30.606	Thread Group ...	HTTP Request	6		342	137	6	1
89	17:24:30.706	Thread Group ...	HTTP Request	5		342	137	5	1
90	17:24:30.806	Thread Group ...	HTTP Request	6		342	137	6	1
91	17:24:30.907	Thread Group ...	HTTP Request	15		342	137	15	2
92	17:24:31.007	Thread Group ...	HTTP Request	6		342	137	6	1
93	17:24:31.108	Thread Group ...	HTTP Request	8		342	137	8	1
94	17:24:31.208	Thread Group ...	HTTP Request	7		342	137	7	2
95	17:24:31.308	Thread Group ...	HTTP Request	8		342	137	8	2
96	17:24:31.410	Thread Group ...	HTTP Request	6		342	137	6	2
97	17:24:31.510	Thread Group ...	HTTP Request	5		342	137	5	1
98	17:24:31.610	Thread Group ...	HTTP Request	9		342	137	9	2
99	17:24:31.705	Thread Group ...	HTTP Request	5		342	137	5	1
100	17:24:31.810	Thread Group ...	HTTP Request	12		342	137	12	3

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- **jmeter_selectAllStudent**

Gambar berikut merupakan gambar untuk screenshot pengaturan pada Thread Group dan hasil untuk load testing selectAllStudent.



Berikut merupakan hasil dari load testing selectAllStudent. Namun terjadi eror dikarenakan kemampuan hardware yang tidak dapat memenuhi permintaan untuk load user sebanyak 100. Berikut merupakan tampilan untuk error tersebut.

```
Console
APAPTutorial6 - ApapTutorial04Application [Spring Boot App] /Library/Java/JavaVirtualMachines/jdk1.8.0_161.jdk/Contents/Home/bin/java (Mar 24, 2018, 4:16:56 PM)

2018-03-24 16:31:55.921 ERROR 7754 --- [io-8080-exec-90] o.a.c.c.C.[.[/].[dispatcherServlet] : Servlet.service() for servlet [dispatcherServlet] in con
java.lang.OutOfMemoryError: GC overhead limit exceeded
    at org.thymeleaf.dom.Element.createClonedInstance(Element.java:370) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
    at org.thymeleaf.dom.Node.cloneNode(Node.java:1095) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
    at org.thymeleaf.dom.NestableNode.doCloneNodeInternals(NestableNode.java:635) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
    at org.thymeleaf.dom.Node.cloneNodeInternals(Node.java:1106) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
    at org.thymeleaf.dom.Node.cloneNode(Node.java:1096) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
    at org.thymeleaf.dom.NestableNode.doCloneNodeInternals(NestableNode.java:635) ~[thymeleaf-2.1.5.RELEASE.jar:2.1.5.RELEASE]
```

Sample #	Start Time	Thread Name	Label	Sample Time(ms)	Status	Bytes	Sent Bytes	Latency	Connect Time(...)
76	16:27:12.356	Thread Group...	HTTP Request	354341	✖	2695	0	0	1
77	16:27:16.278	Thread Group...	HTTP Request	350420	✖	2695	0	0	1
78	16:27:11.950	Thread Group...	HTTP Request	354747	✖	2695	0	0	0
79	16:27:14.463	Thread Group...	HTTP Request	352235	✖	2695	0	0	1
80	16:27:12.254	Thread Group...	HTTP Request	354444	✖	2695	0	0	1
81	16:27:18.279	Thread Group...	HTTP Request	348420	✖	2695	0	0	0
82	16:27:11.850	Thread Group...	HTTP Request	354848	✖	2695	0	0	1
83	16:27:18.178	Thread Group...	HTTP Request	348521	✖	2695	0	0	1
84	16:27:15.573	Thread Group...	HTTP Request	351127	✖	2695	0	0	1
85	16:27:08.721	Thread Group...	HTTP Request	357979	✖	2695	0	0	5
86	16:27:17.878	Thread Group...	HTTP Request	348822	✖	2695	0	0	0
87	16:27:16.779	Thread Group...	HTTP Request	349922	✖	2695	0	0	1
88	16:27:10.639	Thread Group...	HTTP Request	356061	✖	2695	0	0	0
89	16:27:13.962	Thread Group...	HTTP Request	352739	✖	2695	0	0	1
90	16:27:17.777	Thread Group...	HTTP Request	348924	✖	2695	0	0	0
91	16:27:09.024	Thread Group...	HTTP Request	357677	✖	2695	0	0	1
92	16:27:16.574	Thread Group...	HTTP Request	350128	✖	2695	0	0	1
93	16:27:10.741	Thread Group...	HTTP Request	355960	✖	2695	0	0	0
94	16:27:17.480	Thread Group...	HTTP Request	349222	✖	2695	0	0	0
95	16:27:10.438	Thread Group...	HTTP Request	356264	✖	2695	0	0	0
96	16:27:14.566	Thread Group...	HTTP Request	352137	✖	2695	0	0	0
97	16:27:12.456	Thread Group...	HTTP Request	354247	✖	2695	0	0	1
98	16:27:10.336	Thread Group...	HTTP Request	356367	✖	2695	0	0	1
99	16:27:09.628	Thread Group...	HTTP Request	357075	✖	2695	0	0	1
100	16:27:15.368	Thread Group...	HTTP Request	351336	✖	2695	0	0	1

Namun jika jumlah user diganti menjadi 50 user, load testing berhasil dilakukan. Berikut merupakan hasil dari load testing tersebut.

Sample #	Start Time	Thread Name	Label	Sample Time(ms)	Status	Bytes	Sent Bytes	Latency	Connect Time(ms)
13	17:19:22.499	Thread Group ...	HTTP Request	141947	✔	2864648	129	135396	1
14	17:19:21.290	Thread Group ...	HTTP Request	143197	✔	2864648	129	133514	1
15	17:19:21.899	Thread Group ...	HTTP Request	142627	✔	2864648	129	136287	2
16	17:19:24.309	Thread Group ...	HTTP Request	140454	✔	2864648	129	140217	1
17	17:19:21.693	Thread Group ...	HTTP Request	146388	✔	2864648	129	139877	0
18	17:19:29.124	Thread Group ...	HTTP Request	139449	✔	2864648	129	139045	1
19	17:19:24.714	Thread Group ...	HTTP Request	144141	✔	2864648	129	143665	2
20	17:19:22.700	Thread Group ...	HTTP Request	146734	✔	2864648	129	146402	0
21	17:19:22.295	Thread Group ...	HTTP Request	147246	✔	2864648	129	146609	1
22	17:19:24.513	Thread Group ...	HTTP Request	145078	✔	2864648	129	144389	7
23	17:19:25.919	Thread Group ...	HTTP Request	143694	✔	2864648	129	142976	1
24	17:19:22.099	Thread Group ...	HTTP Request	147705	✔	2864648	129	146795	1
25	17:19:28.125	Thread Group ...	HTTP Request	141739	✔	2864648	129	140916	0
26	17:19:25.721	Thread Group ...	HTTP Request	144276	✔	2864648	129	143252	1
27	17:19:24.915	Thread Group ...	HTTP Request	145120	✔	2864648	129	144222	1
28	17:19:25.115	Thread Group ...	HTTP Request	144956	✔	2864648	129	144332	3
29	17:19:26.522	Thread Group ...	HTTP Request	143599	✔	2864648	129	142994	5
30	17:19:27.726	Thread Group ...	HTTP Request	142452	✔	2864648	129	141791	0
31	17:19:26.921	Thread Group ...	HTTP Request	143273	✔	2864648	129	142802	1
32	17:19:23.706	Thread Group ...	HTTP Request	146540	✔	2864648	129	145738	1
33	17:19:28.726	Thread Group ...	HTTP Request	141564	✔	2864648	129	140641	8
34	17:19:25.317	Thread Group ...	HTTP Request	144974	✔	2864648	129	144050	1
35	17:19:27.322	Thread Group ...	HTTP Request	143134	✔	2864648	129	142403	1
36	17:19:27.124	Thread Group ...	HTTP Request	143369	✔	2864648	129	142036	1
37	17:19:22.902	Thread Group ...	HTTP Request	147619	✔	2864648	129	146858	1
38	17:19:24.111	Thread Group ...	HTTP Request	146440	✔	2864648	129	145856	2
39	17:19:23.303	Thread Group ...	HTTP Request	147263	✔	2864648	129	145873	1
40	17:19:28.328	Thread Group ...	HTTP Request	142245	✔	2864648	129	141395	0
41	17:19:23.098	Thread Group ...	HTTP Request	147485	✔	2864648	129	146672	1
42	17:19:23.909	Thread Group ...	HTTP Request	146730	✔	2864648	129	145935	1
43	17:19:28.526	Thread Group ...	HTTP Request	142165	✔	2864648	129	141716	1
44	17:19:26.321	Thread Group ...	HTTP Request	144405	✔	2864648	129	144199	0
45	17:19:27.528	Thread Group ...	HTTP Request	143223	✔	2864648	129	143013	1
46	17:19:26.124	Thread Group ...	HTTP Request	144632	✔	2864648	129	144541	0
47	17:19:25.519	Thread Group ...	HTTP Request	145285	✔	2864648	129	145098	2
48	17:19:26.722	Thread Group ...	HTTP Request	144107	✔	2864648	129	143973	1
49	17:19:28.924	Thread Group ...	HTTP Request	141923	✔	2864648	129	141849	1
50	17:19:27.928	Thread Group ...	HTTP Request	142984	✔	2864648	129	142929	1

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☐ Child samples?
No of Samples 50
Latest Sample 142984
Average 136856
Deviation 15823