

Tutorial 6

Unit Testing dan Load Testing Web App Sederhana

Ringkasan dari materi/hal yang dipelajari

- Unit testing merupakan sebuah metode pengujian pada setiap fungsi yang ada pada program yang telah kita buat. Pada Spring Boot kita bisa menggunakan JUnit dan Mockito untuk melakukan unit testing.
- JUnit adalah framework yang dapat digunakan untuk pengecekan otomatis pada setiap class dan method. Sedangkan, Mockito merupakan sebuah dependencies untuk menciptakan data dummy dalam pengecekan sehingga kita dapat memanipulasi objek untuk dijadikan test case.
- Dalam mengimplementasikan JUnit dan Mockito ada beberapa anotasi yang perlu digunakan seperti: anotasi @Mock yang berguna untuk membuat data dummy agar hasilnya dapat dimanipulasi sesuai dengan test yang ingin dilakukan; anotasi @Before yang digunakan untuk melakukan persiapan sebelum testing; anotasi @Test yang digunakan untuk melakukan unit testing itu sendiri.
- Terdapat 3 segmen yang merupakan logic utama yang akan dilakukan pada setiap testing yaitu Given, When, dan Then. Given, inisialisasi objek yang akan dites dan juga objek yang akan jadi parameter pengecekannya; When akan dilakukan pengujian dengan method yang ingin digunakan; Then akan dilakukan pengecekan terhadap objek baru apakah bernilai null atau sesuai dengan objek yang telah disiapkan sebelumnya untuk pengecekan.
- Selain melakukan unit testing, untuk memastikan program yang kita buat itu bagus kita perlu lakukan load testing. Load testing dilakukan untuk mengetahui performa dan respon dari suatu sistem baik dalam kondisi respon normal maupun dalam kondisi respon yang ekstrim.
- Pada tutorial kali ini kita memanfaatkan tools JMeter untuk melakukan load testing.
- Berdasarkan hasil load testing kita bisa mengetahui kapasitas maksimum dari sistem atau aplikasi yang kita buat dan kita dapat meningkatkan performa sistem/aplikasi tersebut dengan melakukan optimasi pada database dan logic.

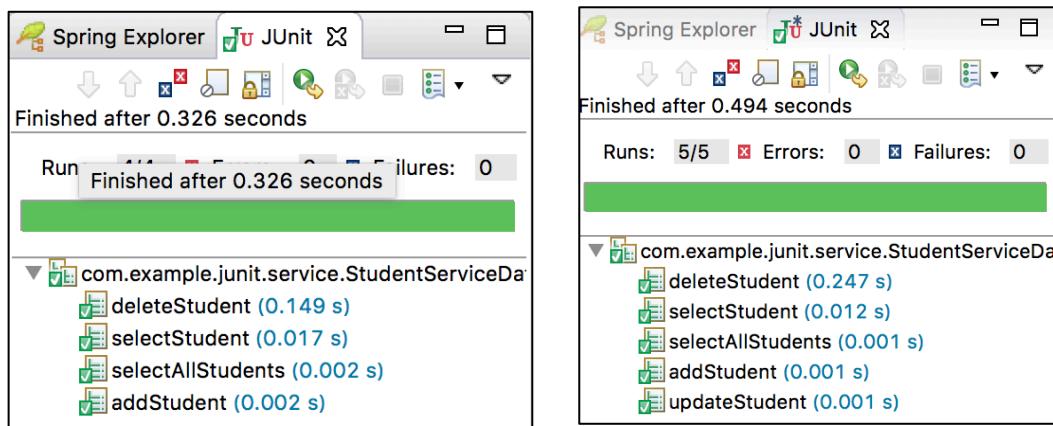
Latihan Unit Testing

1. Apa yang terjadi pada method `public void selectAllStudents()` tersebut berikut dengan hasil testing-nya?
 - Pada Given, dinisialisasi objek berupa List dari StudentModel yang akan dites (`studentModels`) dan juga objek yang akan jadi parameter pengecekannya (`checks`). Setelah itu `BDDMockito.given()` akan melakukan manipulasi terhadap function yang akan dipanggil yaitu `selectAllStudents()` dengan return value sesuai dengan isi dari `willReturn()` yaitu `studentModels`.
 - Pada When akan dilakukan pengujian dengan method `selectAllStudents()`. Method tersebut akan berjalan dengan memasukkannya pada objek baru yaitu `test`.
 - Pada Then akan dilakukan pengecekan terhadap objek baru apakah dia null, apakah dia kosong, apakah jumlahnya benar, ataupun sesuai dengan objek `checks` yang telah disiapkan sebelumnya.
 - Hasil testing-nya passed. Artinya method tersebut berhasil diuji fungsionalitasnya dan tidak memunculkan error/failure apapun.
2. Apa yang terjadi pada method `public void addStudent()` tersebut berikut dengan hasil testing-nya?

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- Pada Given, dinisialisasi objek StudentModel yang akan dites (studentModel) dan juga objek yang akan jadi parameter pengecekannya (check). Setelah itu BDDMockito.given() akan melakukan manipulasi terhadap function yang akan dipanggil yaitu addStudent() dengan return value sesuai dengan isi dari willReturn() yaitu true.
- Pada When akan dilakukan pengujian dengan method addStudent() dengan parameter StudentModel. Method tersebut akan berjalan dengan memasukkannya nilai return-nya ke variabel baru yaitu test.
- Pada Then akan dilakukan pengecekan apakah nilai return-nya sesuai dengan objek checks jika dimasukkan sebagai parameter method addStudent().
- Hasil testing-nya passed. Artinya method tersebut berhasil diuji fungsionalitasnya dan tidak memunculkan error/failure apapun.

3. Untuk pengujian pada testing terhadap method delete student dan update student berikut hasilnya:



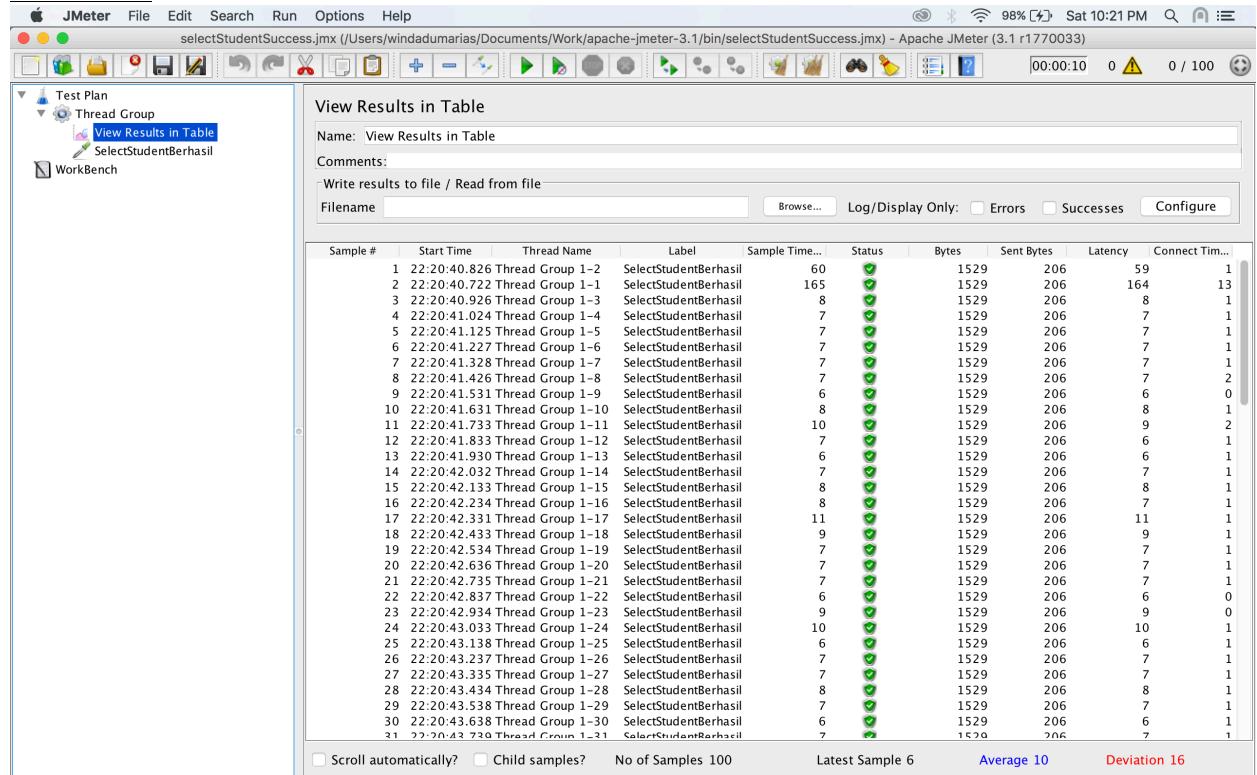
Load Testing

Pada tutorial ini kita melakukan load testing pada fitur selectStudent() dengan kondisi berhasil ditemukan, selectStudent() dengan kondisi gagal ditemukan, dan selectAllStudents() menggunakan Apache JMeter. Berikut adalah hasil dari load testing sebelum dilakukan optimasi.

1. selectStudentBerhasil

Sebelum dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 8.3ms. Hasilnya dapat dilihat pada gambar berikut.

Percobaan1



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Percobaan 2

View Results in Table

Sample #	Start Time	Thread Name	Label	Sample Time...	Status	Bytes	Sent Bytes	Latency	Connect Tim...
1	22:21:06.617	Thread Group 1-1	SelectStudentBerhasil	28	✓	1529	206	28	2
2	22:21:06.719	Thread Group 1-2	SelectStudentBerhasil	6	✓	1529	206	5	1
3	22:21:06.823	Thread Group 1-3	SelectStudentBerhasil	7	✓	1529	206	7	1
4	22:21:06.920	Thread Group 1-4	SelectStudentBerhasil	7	✓	1529	206	7	1
5	22:21:07.020	Thread Group 1-5	SelectStudentBerhasil	6	✓	1529	206	6	1
6	22:21:07.123	Thread Group 1-6	SelectStudentBerhasil	7	✓	1529	206	7	1
7	22:21:07.220	Thread Group 1-7	SelectStudentBerhasil	9	✓	1529	206	9	1
8	22:21:07.322	Thread Group 1-8	SelectStudentBerhasil	8	✓	1529	206	8	1
9	22:21:07.424	Thread Group 1-9	SelectStudentBerhasil	7	✓	1529	206	7	1
10	22:21:07.527	Thread Group 1-10	SelectStudentBerhasil	7	✓	1529	206	7	1
11	22:21:07.627	Thread Group 1-11	SelectStudentBerhasil	6	✓	1529	206	6	1
12	22:21:07.726	Thread Group 1-12	SelectStudentBerhasil	7	✓	1529	206	7	1
13	22:21:07.828	Thread Group 1-13	SelectStudentBerhasil	7	✓	1529	206	7	1
14	22:21:07.927	Thread Group 1-14	SelectStudentBerhasil	8	✓	1529	206	8	1
15	22:21:08.027	Thread Group 1-15	SelectStudentBerhasil	6	✓	1529	206	6	1
16	22:21:08.130	Thread Group 1-16	SelectStudentBerhasil	6	✓	1529	206	6	1
17	22:21:08.227	Thread Group 1-17	SelectStudentBerhasil	7	✓	1529	206	7	1
18	22:21:08.327	Thread Group 1-18	SelectStudentBerhasil	8	✓	1529	206	8	1
19	22:21:08.432	Thread Group 1-19	SelectStudentBerhasil	6	✓	1529	206	6	0
20	22:21:08.533	Thread Group 1-20	SelectStudentBerhasil	7	✓	1529	206	7	2
21	22:21:08.634	Thread Group 1-21	SelectStudentBerhasil	7	✓	1529	206	7	1
22	22:21:08.739	Thread Group 1-22	SelectStudentBerhasil	9	✓	1529	206	9	0
23	22:21:08.836	Thread Group 1-23	SelectStudentBerhasil	9	✓	1529	206	9	1
24	22:21:08.941	Thread Group 1-24	SelectStudentBerhasil	9	✓	1529	206	9	1
25	22:21:09.039	Thread Group 1-25	SelectStudentBerhasil	9	✓	1529	206	9	1
26	22:21:09.142	Thread Group 1-26	SelectStudentBerhasil	6	✓	1529	206	6	1
27	22:21:09.342	Thread Group 1-27	SelectStudentBerhasil	7	✓	1529	206	7	0
28	22:21:09.343	Thread Group 1-28	SelectStudentBerhasil	7	✓	1529	206	7	1
29	22:21:09.443	Thread Group 1-29	SelectStudentBerhasil	7	✓	1529	206	7	1
30	22:21:09.543	Thread Group 1-30	SelectStudentBerhasil	7	✓	1529	206	7	1
31	22:21:00.644	Thread Group 1-31	SelectStudentBerhasil	7	✓	1529	206	7	1

Scroll automatically? Child samples? No of Samples 100 Latest Sample 9 Average 7 Deviation 2

Percobaan 3

View Results in Table

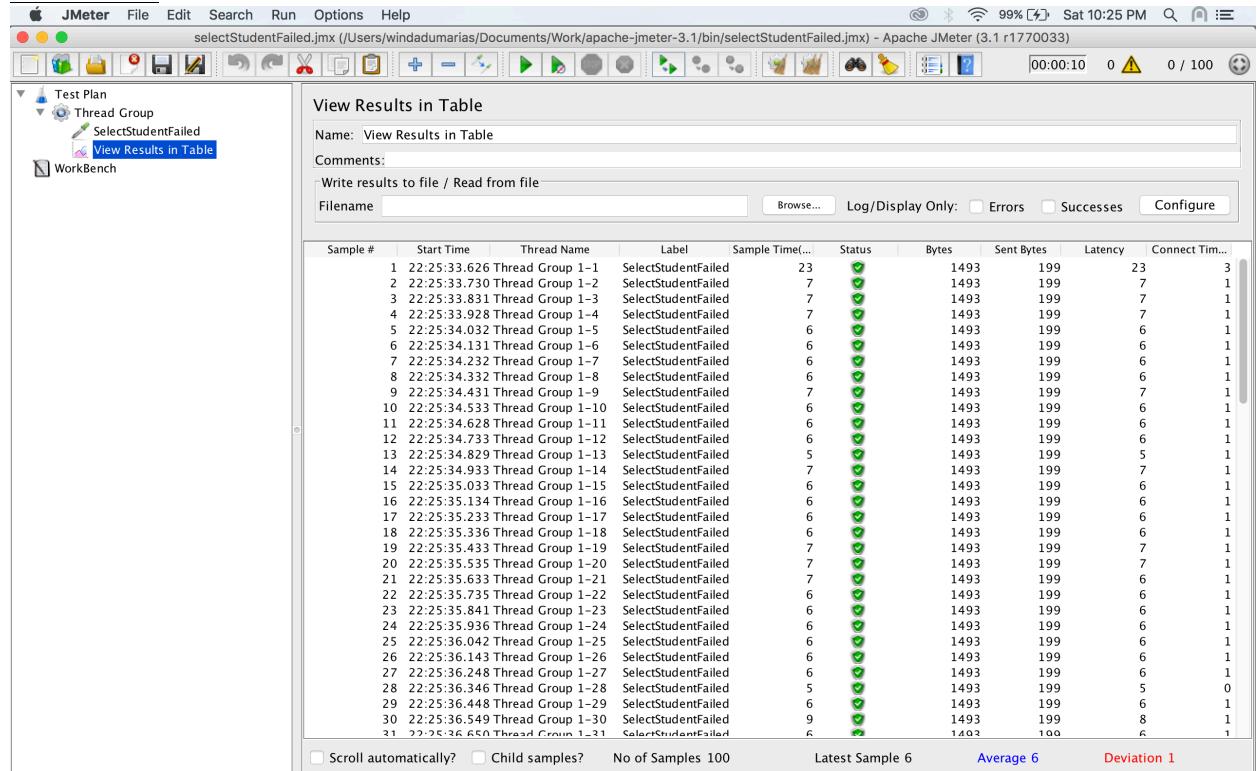
Sample #	Start Time	Thread Name	Label	Sample Time...	Status	Bytes	Sent Bytes	Latency	Connect Tim...
70	22:21:47.200	Thread Group 1-70	SelectStudentBerhasil	7	✓	1529	206	7	1
71	22:21:47.298	Thread Group 1-71	SelectStudentBerhasil	6	✓	1529	206	6	0
72	22:21:47.399	Thread Group 1-72	SelectStudentBerhasil	8	✓	1529	206	8	0
73	22:21:47.499	Thread Group 1-73	SelectStudentBerhasil	22	✓	1529	206	21	0
74	22:21:47.600	Thread Group 1-74	SelectStudentBerhasil	8	✓	1529	206	8	0
75	22:21:47.701	Thread Group 1-75	SelectStudentBerhasil	8	✓	1529	206	8	1
76	22:21:47.804	Thread Group 1-76	SelectStudentBerhasil	6	✓	1529	206	6	1
77	22:21:47.903	Thread Group 1-77	SelectStudentBerhasil	6	✓	1529	206	6	1
78	22:21:48.003	Thread Group 1-78	SelectStudentBerhasil	6	✓	1529	206	6	1
79	22:21:48.104	Thread Group 1-79	SelectStudentBerhasil	6	✓	1529	206	6	1
80	22:21:48.204	Thread Group 1-80	SelectStudentBerhasil	6	✓	1529	206	6	1
81	22:21:48.305	Thread Group 1-81	SelectStudentBerhasil	8	✓	1529	206	8	1
82	22:21:48.406	Thread Group 1-82	SelectStudentBerhasil	7	✓	1529	206	7	1
83	22:21:48.507	Thread Group 1-83	SelectStudentBerhasil	7	✓	1529	206	7	0
84	22:21:48.606	Thread Group 1-84	SelectStudentBerhasil	8	✓	1529	206	7	1
85	22:21:48.702	Thread Group 1-85	SelectStudentBerhasil	9	✓	1529	206	9	2
86	22:21:48.803	Thread Group 1-86	SelectStudentBerhasil	7	✓	1529	206	7	1
87	22:21:48.908	Thread Group 1-87	SelectStudentBerhasil	9	✓	1529	206	9	1
88	22:21:49.003	Thread Group 1-88	SelectStudentBerhasil	9	✓	1529	206	9	1
89	22:21:49.108	Thread Group 1-89	SelectStudentBerhasil	10	✓	1529	206	9	1
90	22:21:49.205	Thread Group 1-90	SelectStudentBerhasil	9	✓	1529	206	9	1
91	22:21:49.306	Thread Group 1-91	SelectStudentBerhasil	7	✓	1529	206	7	0
92	22:21:49.408	Thread Group 1-92	SelectStudentBerhasil	9	✓	1529	206	9	0
93	22:21:49.511	Thread Group 1-93	SelectStudentBerhasil	7	✓	1529	206	7	1
94	22:21:49.612	Thread Group 1-94	SelectStudentBerhasil	6	✓	1529	206	6	1
95	22:21:49.712	Thread Group 1-95	SelectStudentBerhasil	7	✓	1529	206	7	1
96	22:21:49.812	Thread Group 1-96	SelectStudentBerhasil	6	✓	1529	206	6	0
97	22:21:49.912	Thread Group 1-97	SelectStudentBerhasil	6	✓	1529	206	6	1
98	22:21:50.012	Thread Group 1-98	SelectStudentBerhasil	6	✓	1529	206	6	1
99	22:21:50.111	Thread Group 1-99	SelectStudentBerhasil	7	✓	1529	206	6	1
100	22:21:50.212	Thread Group 1-100	SelectStudentBerhasil	8	✓	1529	206	8	1

Scroll automatically? Child samples? No of Samples 100 Latest Sample 8 Average 8 Deviation 2

2. selectStudentGagal

Sebelum dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 7.3ms. Hasilnya dapat dilihat pada gambar berikut.

Percobaan 1



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Percobaan 2

JMeter Test Plan (selectStudentFailed.jmx) - Apache JMeter (3.1 r1770033)

View Results in Table

Name: View Results in Table

Comments:

Write results to file / Read from file

Sample #	Start Time	Thread Name	Label	Sample Time...	Status	Bytes	Sent Bytes	Latency	Connect Tim...
1	22:27:20.492	Thread Group 1-1	SelectStudentFailed	71	✓	1493	199	70	6
2	22:27:20.594	Thread Group 1-2	SelectStudentFailed	12	✓	1493	199	12	2
3	22:27:20.692	Thread Group 1-3	SelectStudentFailed	8	✓	1493	199	8	1
4	22:27:20.798	Thread Group 1-4	SelectStudentFailed	6	✓	1493	199	6	0
5	22:27:20.898	Thread Group 1-5	SelectStudentFailed	7	✓	1493	199	7	1
6	22:27:20.997	Thread Group 1-6	SelectStudentFailed	7	✓	1493	199	7	0
7	22:27:21.099	Thread Group 1-7	SelectStudentFailed	7	✓	1493	199	7	1
8	22:27:21.199	Thread Group 1-8	SelectStudentFailed	7	✓	1493	199	7	1
9	22:27:21.297	Thread Group 1-9	SelectStudentFailed	7	✓	1493	199	7	1
10	22:27:21.400	Thread Group 1-10	SelectStudentFailed	10	✓	1493	199	10	0
11	22:27:21.500	Thread Group 1-11	SelectStudentFailed	12	✓	1493	199	12	1
12	22:27:21.601	Thread Group 1-12	SelectStudentFailed	12	✓	1493	199	12	4
13	22:27:21.702	Thread Group 1-13	SelectStudentFailed	9	✓	1493	199	9	1
14	22:27:21.806	Thread Group 1-14	SelectStudentFailed	6	✓	1493	199	6	1
15	22:27:21.909	Thread Group 1-15	SelectStudentFailed	6	✓	1493	199	6	1
16	22:27:22.009	Thread Group 1-16	SelectStudentFailed	6	✓	1493	199	6	0
17	22:27:22.109	Thread Group 1-17	SelectStudentFailed	7	✓	1493	199	7	1
18	22:27:22.214	Thread Group 1-18	SelectStudentFailed	6	✓	1493	199	6	1
19	22:27:22.315	Thread Group 1-19	SelectStudentFailed	8	✓	1493	199	8	1
20	22:27:22.413	Thread Group 1-20	SelectStudentFailed	8	✓	1493	199	8	1
21	22:27:22.514	Thread Group 1-21	SelectStudentFailed	7	✓	1493	199	7	0
22	22:27:22.617	Thread Group 1-22	SelectStudentFailed	6	✓	1493	199	6	1
23	22:27:22.716	Thread Group 1-23	SelectStudentFailed	7	✓	1493	199	7	1
24	22:27:22.816	Thread Group 1-24	SelectStudentFailed	6	✓	1493	199	6	1
25	22:27:22.917	Thread Group 1-25	SelectStudentFailed	7	✓	1493	199	6	1
26	22:27:23.017	Thread Group 1-26	SelectStudentFailed	6	✓	1493	199	6	1
27	22:27:23.118	Thread Group 1-27	SelectStudentFailed	6	✓	1493	199	6	1
28	22:27:23.217	Thread Group 1-28	SelectStudentFailed	6	✓	1493	199	6	0
29	22:27:23.314	Thread Group 1-29	SelectStudentFailed	6	✓	1493	199	6	1
30	22:27:23.418	Thread Group 1-30	SelectStudentFailed	7	✓	1493	199	7	2
31	22:27:23.517	Thread Group 1-31	SelectStudentFailed	7	✗	1493	100	6	1

Scroll automatically? Child samples? No of Samples 100 Latest Sample 9 Average 7 Deviation 6

Percobaan 3

JMeter Test Plan (selectStudentFailed.jmx) - Apache JMeter (3.1 r1770033)

View Results in Table

Name: View Results in Table

Comments:

Write results to file / Read from file

Sample #	Start Time	Thread Name	Label	Sample Time...	Status	Bytes	Sent Bytes	Latency	Connect Tim...
1	22:27:59.041	Thread Group 1-1	SelectStudentSuccess	24	✓	1493	199	24	5
2	22:27:59.144	Thread Group 1-2	SelectStudentSuccess	7	✓	1493	199	7	1
3	22:27:59.244	Thread Group 1-3	SelectStudentSuccess	7	✓	1493	199	7	1
4	22:27:59.344	Thread Group 1-4	SelectStudentSuccess	7	✓	1493	199	7	1
5	22:27:59.444	Thread Group 1-5	SelectStudentSuccess	7	✓	1493	199	7	1
6	22:27:59.547	Thread Group 1-6	SelectStudentSuccess	7	✓	1493	199	7	1
7	22:27:59.644	Thread Group 1-7	SelectStudentSuccess	6	✓	1493	199	6	1
8	22:27:59.749	Thread Group 1-8	SelectStudentSuccess	6	✓	1493	199	6	1
9	22:27:59.848	Thread Group 1-9	SelectStudentSuccess	7	✓	1493	199	6	1
10	22:27:59.945	Thread Group 1-10	SelectStudentSuccess	5	✓	1493	199	5	0
11	22:28:00.050	Thread Group 1-11	SelectStudentSuccess	6	✓	1493	199	6	1
12	22:28:00.148	Thread Group 1-12	SelectStudentSuccess	6	✓	1493	199	6	1
13	22:28:00.247	Thread Group 1-13	SelectStudentSuccess	6	✓	1493	199	6	1
14	22:28:00.345	Thread Group 1-14	SelectStudentSuccess	6	✓	1493	199	6	1
15	22:28:00.447	Thread Group 1-15	SelectStudentSuccess	6	✓	1493	199	6	0
16	22:28:00.547	Thread Group 1-16	SelectStudentSuccess	7	✓	1493	199	7	1
17	22:28:00.648	Thread Group 1-17	SelectStudentSuccess	5	✓	1493	199	5	0
18	22:28:00.748	Thread Group 1-18	SelectStudentSuccess	5	✓	1493	199	5	0
19	22:28:00.851	Thread Group 1-19	SelectStudentSuccess	7	✓	1493	199	7	0
20	22:28:00.952	Thread Group 1-20	SelectStudentSuccess	6	✓	1493	199	6	1
21	22:28:01.048	Thread Group 1-21	SelectStudentSuccess	7	✓	1493	199	7	1
22	22:28:01.150	Thread Group 1-22	SelectStudentSuccess	6	✓	1493	199	6	1
23	22:28:01.253	Thread Group 1-23	SelectStudentSuccess	6	✓	1493	199	6	1
24	22:28:01.352	Thread Group 1-24	SelectStudentSuccess	6	✓	1493	199	6	1
25	22:28:01.453	Thread Group 1-25	SelectStudentSuccess	7	✓	1493	199	7	1
26	22:28:01.554	Thread Group 1-26	SelectStudentSuccess	6	✓	1493	199	6	1
27	22:28:01.655	Thread Group 1-27	SelectStudentSuccess	8	✓	1493	199	8	1
28	22:28:01.757	Thread Group 1-28	SelectStudentSuccess	8	✓	1493	199	8	0
29	22:28:01.854	Thread Group 1-29	SelectStudentSuccess	5	✓	1493	199	5	0
30	22:28:01.954	Thread Group 1-30	SelectStudentSuccess	10	✓	1493	199	9	2
31	22:28:02.054	Thread Group 1-31	SelectStudentSuccess	6	✓	1493	100	6	1

Scroll automatically? Child samples? No of Samples 100 Latest Sample 7 Average 7 Deviation 3

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3. selectAllStudents

Sebelum dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 15.628,3ms atau 15s. Hasilnya dapat dilihat pada gambar berikut.

Percobaan 1

The screenshot shows the Apache JMeter interface with the following details:

- Test Plan:** Contains a Thread Group labeled "selectAllStudents".
- View Results in Table:** Listener selected.
- Comments:** "Write results to file / Read from file" is checked.
- Filename:** Not specified.
- Log/Display Only:** Options for Errors, Successes, and Configure.
- Table Headers:** Sample #, Start Time, Thread Name, Label, Sample Time(...), Status, Bytes, Sent Bytes, Latency, Connect Time(...).
- Data Rows:** 31 rows of sample data, all successful (Status column has green checkmarks). The first few rows show:
 - Sample # 1: Start Time 21:26:38.774, Thread Name Thread Group..., Label selectAllStude..., Sample Time 8039, Status ✓, Bytes 1849765, Sent Bytes 198, Latency 6977, Connect Time 103.
 - Sample # 2: Start Time 21:26:38.822, Thread Name Thread Group..., Label selectAllStude..., Sample Time 8311, Status ✓, Bytes 1849765, Sent Bytes 198, Latency 7647, Connect Time 55.
- Table Footer:** Options for Scroll automatically?, Child samples?, No of Samples 50, Latest Sample 23429, Average 21216, Deviation 3974.

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Percobaan 2

The screenshot shows the Apache JMeter interface version 3.1. The 'Test Plan' tree on the left contains a 'Thread Group' named 'selectAllStudents'. The 'View Results in Table' listener is selected. The results table displays 50 samples, each with a status of 'Success' (green checkmark). The last sample is labeled 'selectAllStudents'.

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time(...)
1	21:27:44.978	Thread Group	selectAllStudents	1027	✓	1849765	198	956	6
2	21:27:45.181	Thread Group	selectAllStudents	1036	✓	1849765	198	975	1
3	21:27:45.381	Thread Group	selectAllStudents	1839	✓	1849765	198	1744	1
4	21:27:45.581	Thread Group	selectAllStudents	2537	✓	1849765	198	2408	1
5	21:27:45.779	Thread Group	selectAllStudents	4131	✓	1849765	198	3782	1
6	21:27:45.980	Thread Group	selectAllStudents	4152	✓	1849765	198	4109	1
7	21:27:46.181	Thread Group	selectAllStudents	5229	✓	1849765	198	5184	0
8	21:27:46.385	Thread Group	selectAllStudents	7516	✓	1849765	198	7318	0
9	21:27:46.587	Thread Group	selectAllStudents	7870	✓	1849765	198	7821	1
10	21:27:46.784	Thread Group	selectAllStudents	9215	✓	1849765	198	9174	1
11	21:27:46.988	Thread Group	selectAllStudents	11814	✓	1849765	198	11543	0
12	21:27:47.189	Thread Group	selectAllStudents	12241	✓	1849765	198	11953	0
13	21:27:47.390	Thread Group	selectAllStudents	12759	✓	1849765	198	12502	1
14	21:27:47.990	Thread Group	selectAllStudents	12829	✓	1849765	198	12422	0
15	21:27:47.592	Thread Group	selectAllStudents	13964	✓	1849765	198	13290	1
16	21:27:47.788	Thread Group	selectAllStudents	14033	✓	1849765	198	13952	1
17	21:27:48.193	Thread Group	selectAllStudents	14047	✓	1849765	198	13819	1
18	21:27:48.393	Thread Group	selectAllStudents	14016	✓	1849765	198	13970	1
19	21:27:48.999	Thread Group	selectAllStudents	13835	✓	1849765	198	13792	1
20	21:27:48.598	Thread Group	selectAllStudents	17561	✓	1849765	198	14766	1
21	21:27:48.799	Thread Group	selectAllStudents	17368	✓	1849765	198	14308	1
22	21:27:49.812	Thread Group	selectAllStudents	16584	✓	1849765	198	16258	1
23	21:27:49.203	Thread Group	selectAllStudents	17234	✓	1849765	198	16838	0
24	21:27:49.401	Thread Group	selectAllStudents	17082	✓	1849765	198	16838	1
25	21:27:50.415	Thread Group	selectAllStudents	16798	✓	1849765	198	16756	1
26	21:27:50.213	Thread Group	selectAllStudents	17063	✓	1849765	198	16647	1
27	21:27:50.617	Thread Group	selectAllStudents	16702	✓	1849765	198	16325	0
28	21:27:50.013	Thread Group	selectAllStudents	17719	✓	1849765	198	17357	1
29	21:27:49.606	Thread Group	selectAllStudents	18210	✓	1849765	198	18005	1
30	21:27:51.629	Thread Group	selectAllStudents	16335	✓	1849765	198	16279	1
31	21:27:51.621	Thread Group	selectAllStudents	17014	✓	1840765	198	16882	1

Checkboxes at the bottom: Scroll automatically? (unchecked), Child samples? (unchecked), No of Samples 50, Latest Sample 15158, Average 13635, Deviation 4989.

Percobaan 3

The screenshot shows the Apache JMeter interface version 3.1. The 'Test Plan' tree on the left contains a 'Thread Group' named 'selectAllStudents'. The 'View Results in Table' listener is selected. The results table displays 50 samples, each with a status of 'Success' (green checkmark). The last sample is labeled 'selectAllStudents'.

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time(...)
1	21:32:27.379	Thread Group	selectAllStudents	1171	✓	1849765	198	1125	10
2	21:32:27.585	Thread Group	selectAllStudents	1588	✓	1849765	198	1510	1
3	21:32:27.787	Thread Group	selectAllStudents	3548	✓	1849765	198	3479	1
4	21:32:27.988	Thread Group	selectAllStudents	4220	✓	1849765	198	4144	0
5	21:32:28.184	Thread Group	selectAllStudents	5886	✓	1849765	198	5570	1
6	21:32:28.390	Thread Group	selectAllStudents	6839	✓	1849765	198	6473	3
7	21:32:28.790	Thread Group	selectAllStudents	6940	✓	1849765	198	6615	0
8	21:32:28.586	Thread Group	selectAllStudents	7298	✓	1849765	198	6684	2
9	21:32:28.993	Thread Group	selectAllStudents	9429	✓	1849765	198	9386	0
10	21:32:29.194	Thread Group	selectAllStudents	11531	✓	1849765	198	11486	3
11	21:32:29.400	Thread Group	selectAllStudents	11019	✓	1849765	198	10966	1
12	21:32:29.994	Thread Group	selectAllStudents	11426	✓	1849765	198	10718	1
13	21:32:29.396	Thread Group	selectAllStudents	12212	✓	1849765	198	12146	1
14	21:32:29.804	Thread Group	selectAllStudents	12080	✓	1849765	198	12035	1
15	21:32:30.198	Thread Group	selectAllStudents	12009	✓	1849765	198	11950	0
16	21:32:29.594	Thread Group	selectAllStudents	12892	✓	1849765	198	12343	0
17	21:32:30.597	Thread Group	selectAllStudents	12028	✓	1849765	198	11709	1
18	21:32:31.004	Thread Group	selectAllStudents	11939	✓	1849765	198	11605	1
19	21:32:30.804	Thread Group	selectAllStudents	13072	✓	1849765	198	12733	0
20	21:32:31.203	Thread Group	selectAllStudents	13051	✓	1849765	198	12827	0
21	21:32:31.413	Thread Group	selectAllStudents	13189	✓	1849765	198	12985	1
22	21:32:32.816	Thread Group	selectAllStudents	11956	✓	1849765	198	11731	1
23	21:32:32.015	Thread Group	selectAllStudents	12832	✓	1849765	198	12501	0
24	21:32:31.816	Thread Group	selectAllStudents	13171	✓	1849765	198	13111	0
25	21:32:31.614	Thread Group	selectAllStudents	13580	✓	1849765	198	13252	1
26	21:32:32.414	Thread Group	selectAllStudents	13229	✓	1849765	198	13181	0
27	21:32:32.615	Thread Group	selectAllStudents	13145	✓	1849765	198	13086	1
28	21:32:32.212	Thread Group	selectAllStudents	15970	✓	1849765	198	13518	2
29	21:32:33.018	Thread Group	selectAllStudents	15286	✓	1849765	198	15123	0
30	21:32:33.219	Thread Group	selectAllStudents	15294	✓	1849765	198	15155	1
31	21:32:34.026	Thread Group	selectAllStudents	14707	✓	1840765	198	14610	1

Checkboxes at the bottom: Scroll automatically? (unchecked), Child samples? (unchecked), No of Samples 50, Latest Sample 13540, Average 12034, Deviation 3574.

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Kemudian dilakukan optimasi dengan mengganti sql query pada class StudentMapper seperti berikut.

```
@Select("select * from student where npm = #{npm}")
StudentModel selectStudent (@Param("npm") String npm);

@Select("select * from student")
List<StudentModel> selectAllStudents();
```

Selain itu juga dilakukan indexing pada table student yang ada di database dengan menjalankan sql query berikut.

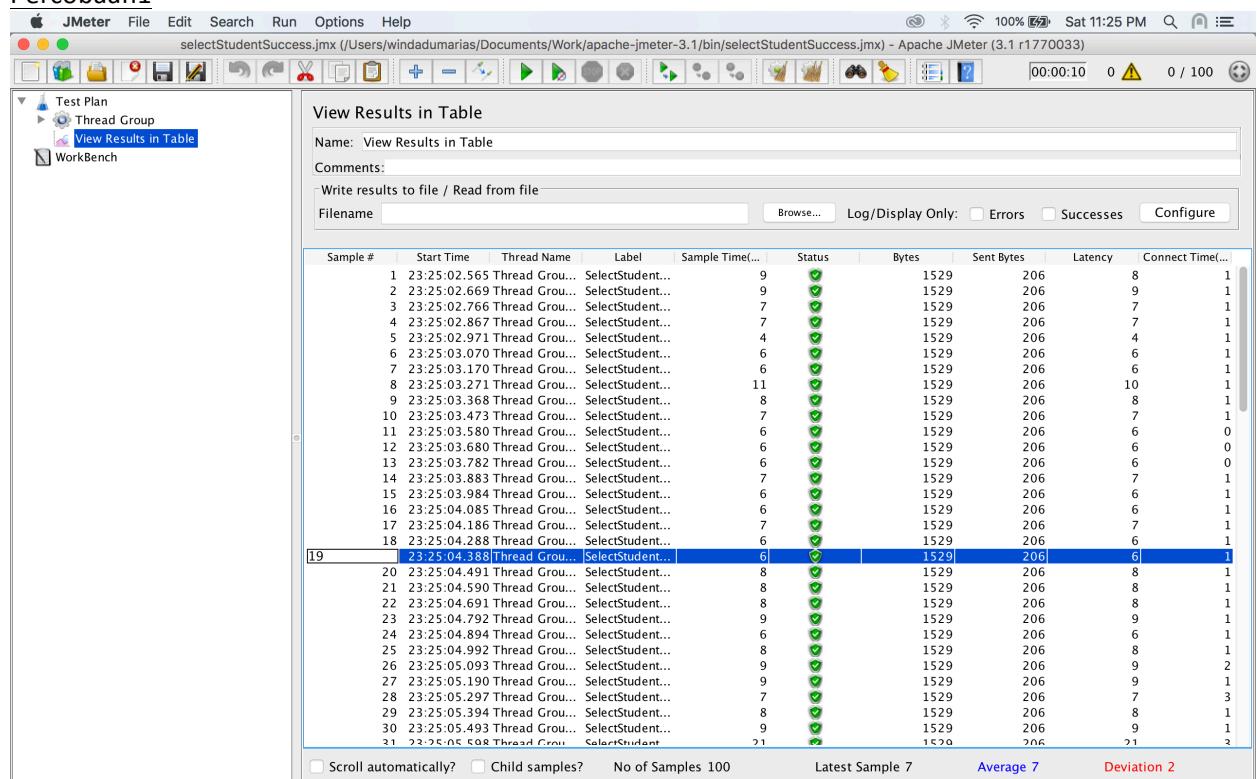
```
CREATE INDEX idx_npm
ON student (npm);
```

Maka hasil setelah dilakukan optimasi rata-rata sample time menurun. Berikut hasil dari load testing setelah dilakukan optimasi.

1. selectStudentBerhasil

Setelah dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 7ms. Hasilnya dapat dilihat pada gambar berikut.

Percobaan1



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Percobaan 2

The screenshot shows the Apache JMeter interface version 3.1. The top menu bar includes JMeter, File, Edit, Search, Run, Options, and Help. The title bar displays 'selectStudentSuccess.jmx (/Users/windadumarias/Documents/Work/apache-jmeter-3.1/bin/selectStudentSuccess.jmx) - Apache JMeter (3.1 r1770033)'. The bottom status bar shows '100% 100% Sat 11:25 PM 00:00:10 0 0 / 100'. The left sidebar shows a 'Test Plan' tree with a 'Thread Group' node expanded, and a 'View Results in Table' button selected. The main area is titled 'View Results in Table' with a sub-section 'Name: View Results in Table'. It contains a 'Comments:' field and a 'Write results to file / Read from file' section with a 'Filename' input field and 'Browse...' button. Below these are 'Log/Display Only' checkboxes for Errors and Successes, and a 'Configure' button. A large table lists 100 samples with columns: Sample #, Start Time, Thread Name, Label, Sample Time(...), Status, Bytes, Sent Bytes, Latency, and Connect Time(...). The first sample is labeled 'SelectStudent...'. The last sample is labeled 'SelectStudent...'. The table footer includes checkboxes for 'Scroll automatically?' and 'Child samples?', and summary statistics: 'No of Samples 100', 'Latest Sample 7', 'Average 7', and 'Deviation 1'.

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time(...)
1	23:25:31.018	Thread Grou...	SelectStudent...	19	✓	1529	206	19	6
2	23:25:31.120	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
3	23:25:31.225	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
4	23:25:31.325	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
5	23:25:31.427	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
6	23:25:31.528	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
7	23:25:31.629	Thread Grou...	SelectStudent...	6	✓	1529	206	6	0
8	23:25:31.728	Thread Grou...	SelectStudent...	8	✓	1529	206	8	1
9	23:25:31.829	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
10	23:25:31.929	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
11	23:25:32.029	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
12	23:25:32.130	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
13	23:25:32.229	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
14	23:25:32.333	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
15	23:25:32.434	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
16	23:25:32.535	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
17	23:25:32.635	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
18	23:25:32.736	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
19	23:25:32.837	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
20	23:25:32.935	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
21	23:25:33.038	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
22	23:25:33.139	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
23	23:25:33.234	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
24	23:25:33.335	Thread Grou...	SelectStudent...	5	✓	1529	206	5	2
25	23:25:33.437	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
26	23:25:33.535	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
27	23:25:33.640	Thread Grou...	SelectStudent...	9	✓	1529	206	8	1
28	23:25:33.736	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
29	23:25:33.841	Thread Grou...	SelectStudent...	9	✓	1529	206	9	1
30	23:25:33.938	Thread Grou...	SelectStudent...	6	✓	1529	206	6	0
31	23:25:34.036	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1

Percobaan 3

The screenshot shows the Apache JMeter interface version 3.1. The top menu bar includes JMeter, File, Edit, Search, Run, Options, and Help. The title bar displays 'selectStudentSuccess.jmx (/Users/windadumarias/Documents/Work/apache-jmeter-3.1/bin/selectStudentSuccess.jmx) - Apache JMeter (3.1 r1770033)'. The bottom status bar shows '100% 100% Sat 11:26 PM 00:00:10 0 0 / 100'. The left sidebar shows a 'Test Plan' tree with a 'Thread Group' node expanded, and a 'View Results in Table' button selected. The main area is titled 'View Results in Table' with a sub-section 'Name: View Results in Table'. It contains a 'Comments:' field and a 'Write results to file / Read from file' section with a 'Filename' input field and 'Browse...' button. Below these are 'Log/Display Only' checkboxes for Errors and Successes, and a 'Configure' button. A large table lists 100 samples with columns: Sample #, Start Time, Thread Name, Label, Sample Time(...), Status, Bytes, Sent Bytes, Latency, and Connect Time(...). The first sample is labeled 'SelectStudent...'. The last sample is labeled 'SelectStudent...'. The table footer includes checkboxes for 'Scroll automatically?' and 'Child samples?', and summary statistics: 'No of Samples 100', 'Latest Sample 7', 'Average 7', and 'Deviation 2'.

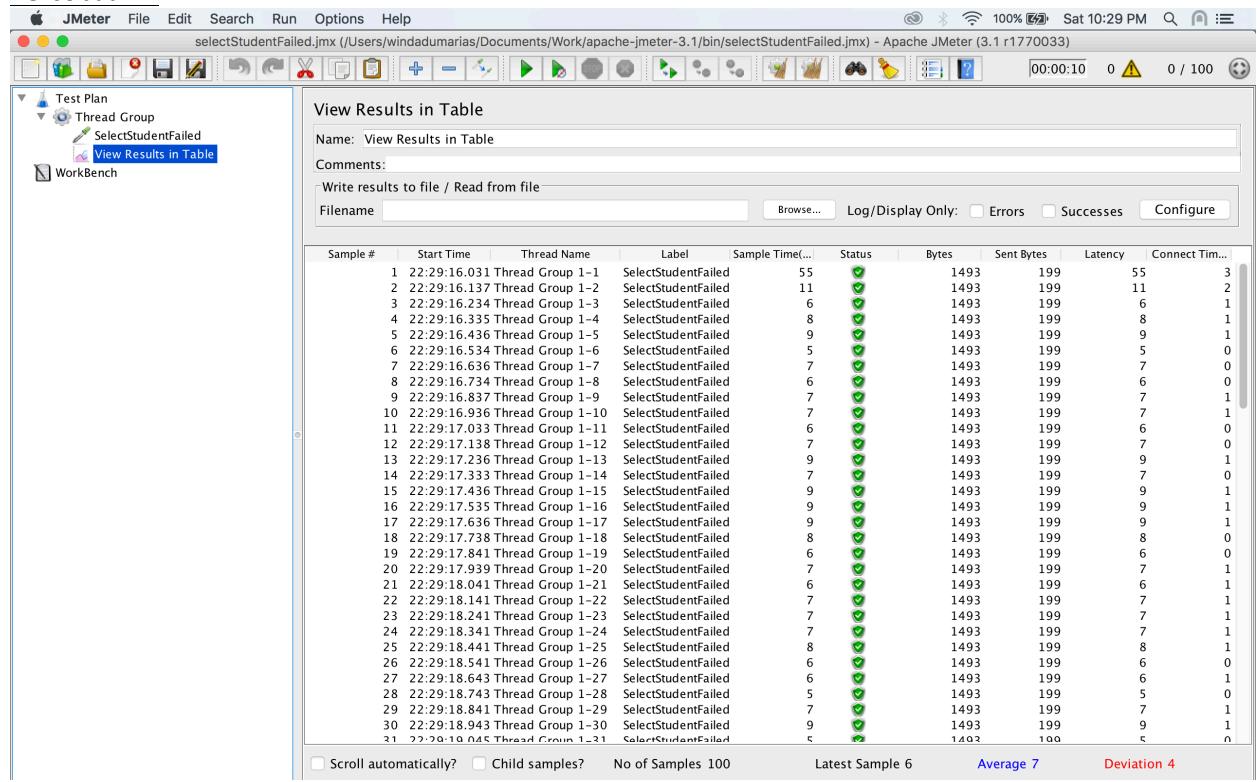
Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time(...)
1	23:25:49.680	Thread Grou...	SelectStudent...	18	✓	1529	206	17	3
2	23:25:49.785	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
3	23:25:49.886	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
4	23:25:49.987	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
5	23:25:50.087	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
6	23:25:50.188	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
7	23:25:50.289	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
8	23:25:50.391	Thread Grou...	SelectStudent...	6	✓	1529	206	6	0
9	23:25:50.492	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
10	23:25:50.592	Thread Grou...	SelectStudent...	9	✓	1529	206	9	1
11	23:25:50.692	Thread Grou...	SelectStudent...	18	✓	1529	206	17	4
12	23:25:50.794	Thread Grou...	SelectStudent...	11	✓	1529	206	11	2
13	23:25:50.893	Thread Grou...	SelectStudent...	11	✓	1529	206	11	1
14	23:25:50.995	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
15	23:25:51.096	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
16	23:25:51.198	Thread Grou...	SelectStudent...	8	✓	1529	206	8	1
17	23:25:51.296	Thread Grou...	SelectStudent...	7	✓	1529	206	7	1
18	23:25:51.399	Thread Grou...	SelectStudent...	9	✓	1529	206	9	1
19	23:25:51.496	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
20	23:25:51.597	Thread Grou...	SelectStudent...	12	✓	1529	206	11	2
21	23:25:51.705	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
22	23:25:51.806	Thread Grou...	SelectStudent...	8	✓	1529	206	8	1
23	23:25:51.906	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
24	23:25:52.002	Thread Grou...	SelectStudent...	8	✓	1529	206	8	1
25	23:25:52.106	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
26	23:25:52.207	Thread Grou...	SelectStudent...	6	✓	1529	206	5	0
27	23:25:52.307	Thread Grou...	SelectStudent...	6	✓	1529	206	6	1
28	23:25:52.407	Thread Grou...	SelectStudent...	9	✓	1529	206	9	2
29	23:25:52.506	Thread Grou...	SelectStudent...	9	✓	1529	206	9	2
30	23:25:52.607	Thread Grou...	SelectStudent...	8	✓	1529	206	8	2
31	23:25:52.707	Thread Grou...	SelectStudent...	6	✓	1529	206	6	0

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2. selectStudentGagal

Setelah dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 6.3ms. Hasilnya dapat dilihat pada gambar berikut.

Percobaan 1



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Percobaan 2

View Results in Table

Name: View Results in Table

Comments:

Write results to file / Read from file

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Tim...
1	22:29:51.857	Thread Group 1-1	SelectStudentFailed	20	✓	1493	199	20	5
2	22:29:51.961	Thread Group 1-2	SelectStudentFailed	5	✓	1493	199	5	0
3	22:29:52.063	Thread Group 1-3	SelectStudentFailed	6	✓	1493	199	6	1
4	22:29:52.163	Thread Group 1-4	SelectStudentFailed	6	✓	1493	199	6	1
5	22:29:52.263	Thread Group 1-5	SelectStudentFailed	7	✓	1493	199	7	1
6	22:29:52.364	Thread Group 1-6	SelectStudentFailed	6	✓	1493	199	6	1
7	22:29:52.464	Thread Group 1-7	SelectStudentFailed	6	✓	1493	199	6	0
8	22:29:52.563	Thread Group 1-8	SelectStudentFailed	6	✓	1493	199	6	1
9	22:29:52.664	Thread Group 1-9	SelectStudentFailed	5	✓	1493	199	5	0
10	22:29:52.764	Thread Group 1-10	SelectStudentFailed	5	✓	1493	199	5	1
11	22:29:52.865	Thread Group 1-11	SelectStudentFailed	6	✓	1493	199	6	1
12	22:29:52.964	Thread Group 1-12	SelectStudentFailed	6	✓	1493	199	6	1
13	22:29:53.064	Thread Group 1-13	SelectStudentFailed	6	✓	1493	199	6	1
14	22:29:53.163	Thread Group 1-14	SelectStudentFailed	7	✓	1493	199	7	1
15	22:29:53.263	Thread Group 1-15	SelectStudentFailed	7	✓	1493	199	6	1
16	22:29:53.363	Thread Group 1-16	SelectStudentFailed	6	✓	1493	199	6	1
17	22:29:53.462	Thread Group 1-17	SelectStudentFailed	6	✓	1493	199	6	1
18	22:29:53.563	Thread Group 1-18	SelectStudentFailed	6	✓	1493	199	6	1
19	22:29:53.663	Thread Group 1-19	SelectStudentFailed	6	✓	1493	199	6	1
20	22:29:53.766	Thread Group 1-20	SelectStudentFailed	6	✓	1493	199	6	1
21	22:29:53.866	Thread Group 1-21	SelectStudentFailed	6	✓	1493	199	6	1
22	22:29:53.966	Thread Group 1-22	SelectStudentFailed	6	✓	1493	199	6	1
23	22:29:54.068	Thread Group 1-23	SelectStudentFailed	6	✓	1493	199	6	1
24	22:29:54.169	Thread Group 1-24	SelectStudentFailed	6	✓	1493	199	6	1
25	22:29:54.272	Thread Group 1-25	SelectStudentFailed	6	✓	1493	199	6	1
26	22:29:54.369	Thread Group 1-26	SelectStudentFailed	6	✓	1493	199	6	1
27	22:29:54.471	Thread Group 1-27	SelectStudentFailed	7	✓	1493	199	7	1
28	22:29:54.572	Thread Group 1-28	SelectStudentFailed	6	✓	1493	199	6	1
29	22:29:54.673	Thread Group 1-29	SelectStudentFailed	7	✓	1493	199	7	1
30	22:29:54.771	Thread Group 1-30	SelectStudentFailed	6	✓	1493	199	6	1
31	22:29:54.875	Thread Group 1-31	SelectStudentFailed	6	✓	1493	199	6	1

Scroll automatically? Child samples? No of Samples 100 Latest Sample 8 Average 6 Deviation 1

Percobaan 3

View Results in Table

Name: View Results in Table

Comments:

Write results to file / Read from file

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Tim...
1	22:30:50.243	Thread Group 1-1	SelectStudentFailed	21	✓	1493	199	21	5
2	22:30:50.346	Thread Group 1-2	SelectStudentFailed	6	✓	1493	199	6	1
3	22:30:50.446	Thread Group 1-3	SelectStudentFailed	7	✓	1493	199	7	1
4	22:30:50.546	Thread Group 1-4	SelectStudentFailed	6	✓	1493	199	6	1
5	22:30:50.645	Thread Group 1-5	SelectStudentFailed	5	✓	1493	199	5	1
6	22:30:50.746	Thread Group 1-6	SelectStudentFailed	6	✓	1493	199	6	1
7	22:30:50.846	Thread Group 1-7	SelectStudentFailed	6	✓	1493	199	6	1
8	22:30:50.945	Thread Group 1-8	SelectStudentFailed	7	✓	1493	199	6	1
9	22:30:51.047	Thread Group 1-9	SelectStudentFailed	6	✓	1493	199	6	1
10	22:30:51.146	Thread Group 1-10	SelectStudentFailed	6	✓	1493	199	6	1
11	22:30:51.249	Thread Group 1-11	SelectStudentFailed	6	✓	1493	199	6	1
12	22:30:51.347	Thread Group 1-12	SelectStudentFailed	6	✓	1493	199	6	1
13	22:30:51.446	Thread Group 1-13	SelectStudentFailed	7	✓	1493	199	7	1
14	22:30:51.552	Thread Group 1-14	SelectStudentFailed	5	✓	1493	199	5	1
15	22:30:51.650	Thread Group 1-15	SelectStudentFailed	6	✓	1493	199	6	1
16	22:30:51.754	Thread Group 1-16	SelectStudentFailed	6	✓	1493	199	6	1
17	22:30:51.854	Thread Group 1-17	SelectStudentFailed	6	✓	1493	199	5	1
18	22:30:51.955	Thread Group 1-18	SelectStudentFailed	6	✓	1493	199	6	1
19	22:30:52.056	Thread Group 1-19	SelectStudentFailed	6	✓	1493	199	6	1
20	22:30:52.157	Thread Group 1-20	SelectStudentFailed	8	✓	1493	199	8	1
21	22:30:52.259	Thread Group 1-21	SelectStudentFailed	8	✓	1493	199	8	0
22	22:30:52.360	Thread Group 1-22	SelectStudentFailed	7	✓	1493	199	7	0
23	22:30:52.464	Thread Group 1-23	SelectStudentFailed	5	✓	1493	199	5	1
24	22:30:52.569	Thread Group 1-24	SelectStudentFailed	6	✓	1493	199	6	1
25	22:30:52.669	Thread Group 1-25	SelectStudentFailed	6	✓	1493	199	6	1
26	22:30:52.765	Thread Group 1-26	SelectStudentFailed	6	✓	1493	199	6	1
27	22:30:52.864	Thread Group 1-27	SelectStudentFailed	6	✓	1493	199	6	1
28	22:30:52.966	Thread Group 1-28	SelectStudentFailed	7	✓	1493	199	7	1
29	22:30:53.067	Thread Group 1-29	SelectStudentFailed	7	✓	1493	199	7	1
30	22:30:53.169	Thread Group 1-30	SelectStudentFailed	6	✓	1493	199	6	0

Scroll automatically? Child samples? No of Samples 100 Latest Sample 6 Average 6 Deviation 1

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3. selectAllStudents

Setelah dilakukan optimasi, hasil load testing yang telah dilakukan rata-rata sample time yang diperoleh selama 3 kali percobaan adalah 9432ms atau 9s. Hasilnya dapat dilihat pada gambar berikut.

Percobaan 1

The screenshot shows the Apache JMeter interface with a successful test run. The left sidebar displays a 'Test Plan' tree with a 'Thread Group' node expanded, containing a 'selectAllStudents' sampler. The main panel is titled 'View Results in Table' and shows a table of results for this sampler. The table has columns for Sample #, Start Time, Thread Name, Label, Sample Time, Status, Bytes, Sent Bytes, Latency, and Connect Time. All samples show a status of 'OK' (green checkmark) and a latency of 0. The 'Log/Display Only' checkbox is checked.

Sample #	Start Time	Thread Name	Label	Sample Time...	Status	Bytes	Sent Bytes	Latency	Connect Time...
1	22:36:58.632	Thread Group...	selectAllStudents	946	OK	1849765	198	900	2
2	22:36:58.835	Thread Group...	selectAllStudents	1598	OK	1849765	198	1500	0
3	22:36:59.034	Thread Group...	selectAllStudents	2359	OK	1849765	198	2166	1
4	22:36:59.232	Thread Group...	selectAllStudents	2491	OK	1849765	198	2393	1
5	22:36:59.438	Thread Group...	selectAllStudents	2771	OK	1849765	198	2727	0
6	22:36:59.634	Thread Group...	selectAllStudents	3497	OK	1849765	198	3306	1
7	22:36:59.834	Thread Group...	selectAllStudents	4997	OK	1849765	198	3587	1
8	22:37:00.034	Thread Group...	selectAllStudents	5722	OK	1849765	198	5680	0
9	22:37:00.238	Thread Group...	selectAllStudents	6024	OK	1849765	198	5971	0
10	22:37:00.436	Thread Group...	selectAllStudents	6740	OK	1849765	198	6255	2
11	22:37:00.838	Thread Group...	selectAllStudents	7132	OK	1849765	198	6584	1
12	22:37:00.636	Thread Group...	selectAllStudents	8184	OK	1849765	198	7949	0
13	22:37:01.037	Thread Group...	selectAllStudents	8290	OK	1849765	198	7913	0
14	22:37:01.234	Thread Group...	selectAllStudents	8718	OK	1849765	198	8661	0
15	22:37:01.436	Thread Group...	selectAllStudents	9394	OK	1849765	198	9155	1
16	22:37:01.636	Thread Group...	selectAllStudents	10104	OK	1849765	198	9714	0
17	22:37:01.837	Thread Group...	selectAllStudents	10383	OK	1849765	198	9893	0
18	22:37:02.039	Thread Group...	selectAllStudents	10399	OK	1849765	198	9882	0
19	22:37:02.434	Thread Group...	selectAllStudents	10259	OK	1849765	198	10206	1
20	22:37:02.237	Thread Group...	selectAllStudents	10766	OK	1849765	198	10555	2
21	22:37:02.835	Thread Group...	selectAllStudents	10561	OK	1849765	198	10516	0
22	22:37:02.639	Thread Group...	selectAllStudents	11065	OK	1849765	198	10887	0
23	22:37:04.441	Thread Group...	selectAllStudents	9351	OK	1849765	198	9304	1
24	22:37:03.436	Thread Group...	selectAllStudents	11064	OK	1849765	198	11007	1
25	22:37:03.040	Thread Group...	selectAllStudents	11794	OK	1849765	198	11508	1
26	22:37:03.240	Thread Group...	selectAllStudents	11762	OK	1849765	198	11355	1
27	22:37:05.441	Thread Group...	selectAllStudents	9612	OK	1849765	198	9257	0
28	22:37:04.037	Thread Group...	selectAllStudents	11053	OK	1849765	198	10872	0
29	22:37:05.244	Thread Group...	selectAllStudents	9976	OK	1849765	198	9929	1
30	22:37:04.841	Thread Group...	selectAllStudents	10535	OK	1849765	198	10301	1
31	22:37:04.441	Thread Group...	selectAllStudents	11707	OK	1849765	198	10500	1

Nama : Winda Dumaria Simanjuntak
NPM : 1706107075

Percobaan 2

Apache JMeter Test Plan (selectStudentFailed.jmx)

View Results in Table

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time...
1	22:37:37.906	Thread Group... selectAllStudents	selectAllStudents	836	✓	1849765	198	782	4
2	22:37:38.110	Thread Group... selectAllStudents	selectAllStudents	1140	✓	1849765	198	1048	0
3	22:37:38.308	Thread Group... selectAllStudents	selectAllStudents	1913	✓	1849765	198	1858	0
4	22:37:38.508	Thread Group... selectAllStudents	selectAllStudents	2602	✓	1849765	198	2463	0
5	22:37:38.710	Thread Group... selectAllStudents	selectAllStudents	2540	✓	1849765	198	2401	1
6	22:37:38.909	Thread Group... selectAllStudents	selectAllStudents	2972	✓	1849765	198	2921	0
7	22:37:39.110	Thread Group... selectAllStudents	selectAllStudents	3581	✓	1849765	198	3350	1
8	22:37:39.313	Thread Group... selectAllStudents	selectAllStudents	3924	✓	1849765	198	3582	0
9	22:37:39.914	Thread Group... selectAllStudents	selectAllStudents	3998	✓	1849765	198	3953	1
10	22:37:39.514	Thread Group... selectAllStudents	selectAllStudents	4640	✓	1849765	198	4590	0
11	22:37:40.113	Thread Group... selectAllStudents	selectAllStudents	4664	✓	1849765	198	4546	0
12	22:37:40.314	Thread Group... selectAllStudents	selectAllStudents	5479	✓	1849765	198	5149	1
13	22:37:40.113	Thread Group... selectAllStudents	selectAllStudents	6164	✓	1849765	198	6121	1
14	22:37:40.514	Thread Group... selectAllStudents	selectAllStudents	8809	✓	1849765	198	8767	0
15	22:37:40.711	Thread Group... selectAllStudents	selectAllStudents	8995	✓	1849765	198	8918	1
16	22:37:40.914	Thread Group... selectAllStudents	selectAllStudents	9787	✓	1849765	198	9437	1
17	22:37:41.313	Thread Group... selectAllStudents	selectAllStudents	9518	✓	1849765	198	9472	1
18	22:37:41.111	Thread Group... selectAllStudents	selectAllStudents	10404	✓	1849765	198	9709	0
19	22:37:41.516	Thread Group... selectAllStudents	selectAllStudents	11160	✓	1849765	198	11113	1
20	22:37:41.716	Thread Group... selectAllStudents	selectAllStudents	11115	✓	1849765	198	10548	1
21	22:37:42.317	Thread Group... selectAllStudents	selectAllStudents	10918	✓	1849765	198	10859	0
22	22:37:41.914	Thread Group... selectAllStudents	selectAllStudents	11385	✓	1849765	198	10994	1
23	22:37:42.115	Thread Group... selectAllStudents	selectAllStudents	11376	✓	1849765	198	11133	1
24	22:37:42.518	Thread Group... selectAllStudents	selectAllStudents	11647	✓	1849765	198	11456	1
25	22:37:43.319	Thread Group... selectAllStudents	selectAllStudents	11007	✓	1849765	198	10677	0
26	22:37:43.118	Thread Group... selectAllStudents	selectAllStudents	11481	✓	1849765	198	11272	0
27	22:37:42.717	Thread Group... selectAllStudents	selectAllStudents	11986	✓	1849765	198	11676	2
28	22:37:42.913	Thread Group... selectAllStudents	selectAllStudents	12484	✓	1849765	198	12231	1
29	22:37:43.918	Thread Group... selectAllStudents	selectAllStudents	11891	✓	1849765	198	11567	2
30	22:37:44.522	Thread Group... selectAllStudents	selectAllStudents	11391	✓	1849765	198	11240	1
31	22:37:43.717	Thread Group... selectAllStudents	selectAllStudents	12248	✓	1849765	198	12024	0

Latest Sample 11586 Average 9172 Deviation 3580

Percobaan 3

Apache JMeter Test Plan (selectStudentFailed.jmx)

View Results in Table

Sample #	Start Time	Thread Name	Label	Sample Time(...)	Status	Bytes	Sent Bytes	Latency	Connect Time...
1	22:38:19.880	Thread Group... selectAllStudents	selectAllStudents	880	✓	1849765	198	795	4
2	22:38:20.081	Thread Group... selectAllStudents	selectAllStudents	1072	✓	1849765	198	1022	1
3	22:38:20.281	Thread Group... selectAllStudents	selectAllStudents	1890	✓	1849765	198	1849	0
4	22:38:20.481	Thread Group... selectAllStudents	selectAllStudents	3326	✓	1849765	198	3137	1
5	22:38:20.683	Thread Group... selectAllStudents	selectAllStudents	3505	✓	1849765	198	3315	1
6	22:38:20.884	Thread Group... selectAllStudents	selectAllStudents	3704	✓	1849765	198	3651	0
7	22:38:21.088	Thread Group... selectAllStudents	selectAllStudents	4625	✓	1849765	198	4524	0
8	22:38:21.486	Thread Group... selectAllStudents	selectAllStudents	5571	✓	1849765	198	5439	0
9	22:38:21.288	Thread Group... selectAllStudents	selectAllStudents	5993	✓	1849765	198	5593	0
10	22:38:21.685	Thread Group... selectAllStudents	selectAllStudents	6386	✓	1849765	198	6109	1
11	22:38:21.889	Thread Group... selectAllStudents	selectAllStudents	8528	✓	1849765	198	8257	1
12	22:38:22.090	Thread Group... selectAllStudents	selectAllStudents	8697	✓	1849765	198	8245	0
13	22:38:22.289	Thread Group... selectAllStudents	selectAllStudents	8541	✓	1849765	198	8018	1
14	22:38:22.489	Thread Group... selectAllStudents	selectAllStudents	9268	✓	1849765	198	9082	0
15	22:38:23.490	Thread Group... selectAllStudents	selectAllStudents	9119	✓	1849765	198	8954	0
16	22:38:22.887	Thread Group... selectAllStudents	selectAllStudents	10162	✓	1849765	198	9887	1
17	22:38:22.692	Thread Group... selectAllStudents	selectAllStudents	10392	✓	1849765	198	9954	0
18	22:38:23.692	Thread Group... selectAllStudents	selectAllStudents	9584	✓	1849765	198	9216	0
19	22:38:23.892	Thread Group... selectAllStudents	selectAllStudents	9595	✓	1849765	198	8825	1
20	22:38:24.089	Thread Group... selectAllStudents	selectAllStudents	9587	✓	1849765	198	9345	1
21	22:38:23.090	Thread Group... selectAllStudents	selectAllStudents	10717	✓	1849765	198	10548	0
22	22:38:23.292	Thread Group... selectAllStudents	selectAllStudents	13047	✓	1849765	198	10191	0
23	22:38:24.290	Thread Group... selectAllStudents	selectAllStudents	12137	✓	1849765	198	9192	0
24	22:38:24.692	Thread Group... selectAllStudents	selectAllStudents	12104	✓	1849765	198	11890	1
25	22:38:24.491	Thread Group... selectAllStudents	selectAllStudents	12401	✓	1849765	198	12227	1
26	22:38:24.890	Thread Group... selectAllStudents	selectAllStudents	12199	✓	1849765	198	12132	0
27	22:38:25.091	Thread Group... selectAllStudents	selectAllStudents	12067	✓	1849765	198	11532	1
28	22:38:25.691	Thread Group... selectAllStudents	selectAllStudents	11972	✓	1849765	198	11926	1
29	22:38:25.293	Thread Group... selectAllStudents	selectAllStudents	12657	✓	1849765	198	12609	0
30	22:38:26.092	Thread Group... selectAllStudents	selectAllStudents	12226	✓	1849765	198	12184	0
31	22:38:25.403	Thread Group... selectAllStudents	selectAllStudents	13028	✓	1849765	198	12857	1

Latest Sample 10523 Average 9715 Deviation 3328