

# Summary

**Sink States:** $0(0 \times 10^0)$

Table 1: Pulse Analysis Summary

| Classes         | Methods | States | Unsatisfiable Clauses | Unreachable States | Possible concurrent Methods | Total. no. of pairs | No. of concurrent pairs | Percentage of concurrent Methods |
|-----------------|---------|--------|-----------------------|--------------------|-----------------------------|---------------------|-------------------------|----------------------------------|
| Webserver       | 8       | 1      | 0                     | 0                  | 7                           | 36                  | 22                      | 61                               |
| Server          | 2       | 1      | 0                     | 0                  | 0                           | 3                   | 0                       | 0                                |
| Client          | 2       | 1      | 0                     | 0                  | 1                           | 3                   | 1                       | 33                               |
| Total Classes=3 | 12      | 3      | 0                     | 0                  | 8                           | 42                  | 23                      | 55                               |

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# 1 Webservice

Table 2: Methods Requires Clause Satisfiability

| Method         | Satisfiability |
|----------------|----------------|
| Webservice     | ✓              |
| main           | ✓              |
| webserver      | ✓              |
| serveClient    | ✓              |
| LOG            | ✓              |
| transfer       | ✓              |
| transferHeader | ✓              |
| transferData   | ✓              |

Table 3: State Transition Matrix

|       |       |
|-------|-------|
|       | alive |
| alive | ↑     |

Table 4: Methods Concurrency Matrix

|                | Webservice | main | webserver | serveClient | LOG | transfer | transferHeader | transferData |
|----------------|------------|------|-----------|-------------|-----|----------|----------------|--------------|
| Webservice     | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| main           | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| webserver      | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| serveClient    | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| LOG            | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| transfer       | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| transferHeader | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |
| transferData   | ⌘          | ⌘    | ⌘         | ⌘           | ⌘   | ⌘        | ⌘              | ⌘            |

## 2 Server

Table 5: Methods Requires Clause Satisfiability

| Method | Satisfiability |
|--------|----------------|
| Server | ✓              |
| main   | ✓              |

Table 6: State Transition Matrix

|       |       |
|-------|-------|
|       | alive |
| alive | ↑     |

Table 7: Methods Concurrency Matrix

|        |        |      |
|--------|--------|------|
|        | Server | main |
| Server | ⧻      | ⧻    |
| main   | ⧻      | ⧻    |

### 3 Client

Table 8: Methods Requires Clause Satisfiability

| Method | Satisfiability |
|--------|----------------|
| Client | ✓              |
| main   | ✓              |

Table 9: State Transition Matrix

|       |       |
|-------|-------|
|       | alive |
| alive | ↑     |

Table 10: Methods Concurrency Matrix

|        |        |      |
|--------|--------|------|
|        | Client | main |
| Client | ⦿      | ⦿    |
| main   | ⦿      |      |

## 4 Abbreviation

Table 11: Used Abbreviation

| Symbol | Meaning   |
|--------|---|
| ✓      | requires clause of the method is satisfiable                            |
| ✗      | requires clause of the method is unsatisfiable                          |
| ↑      | The row-state can be transitioned to the column-state                   |
| ✕      | The row-state cannot be transitioned to the column-state                |
|        | The row-method can be possibly executed parallel with the column-method |
| ⋈      | The row-method cannot be executed parallel with the column-method       |

## 5 Annotated Version of Sequential Java Program generated by Sip4j

```
1 package outputs;
2 import edu.cmu.cs.plural.annot.*;
3
4 @ClassStates({@State(name = "alive")})
5 class Webserver {
6   @Perm(ensures="unique(this) in alive")
7   Webserver() { }
8
9   @Perm(requires="unique(this) in alive",
10  ensures="unique(this) in alive")
11   void main(String[] args) {
12   }
13   @Perm(requires="unique(this) in alive",
14  ensures="unique(this) in alive")
15   void webserver() {
16   }
17   @Perm(requires="full(this) in alive",
18  ensures="full(this) in alive")
19   void serveClient(Socket socketClient) {
20   }
21
22   void LOG(String msg, Object... args) {
23   }
24
25   void transfer(OutputStream outStream, File file) {
26   }
27
28   void transferHeader(Writer writer, File file) {
29   }
30
31   void transferData(Writer outWriter, Reader inReader, long count) {
32   }
33 }
34 }ENDOFCLASS
35
36 @ClassStates({@State(name = "alive")})
37
38 class Server {
39   @Perm(ensures="unique(this) in alive")
40   Server() { }
41
42   @Perm(requires="unique(this) in alive",
43  ensures="unique(this) in alive")
44   void main(String argv[]) {
45   }
46 }
47 }ENDOFCLASS
48
49 @ClassStates({@State(name = "alive")})
50
51 class Client {
52   @Perm(ensures="unique(this) in alive")
53   Client() { }
54
55   void main(String argv[]) {
56   }
57 }
58 }ENDOFCLASS
```