

# Testování stavového automatu

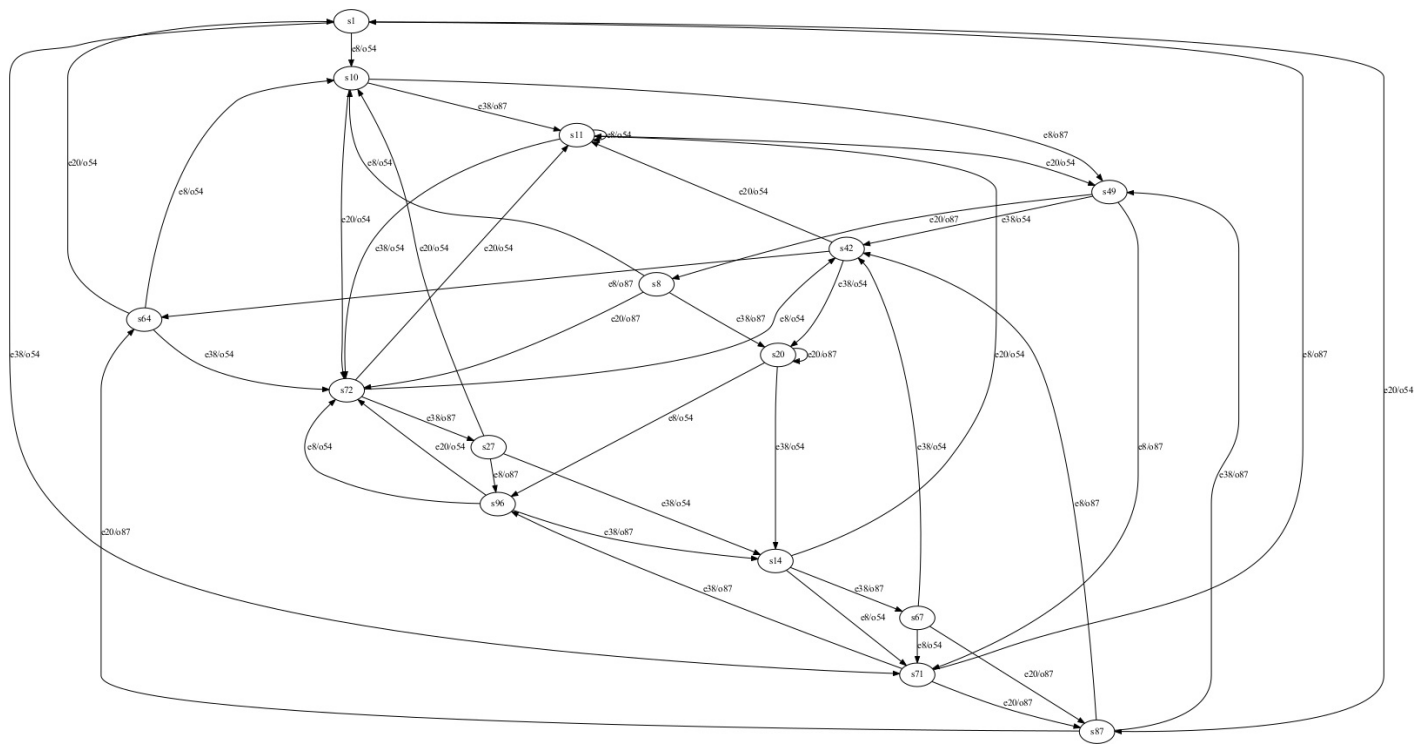
Skupina: **10**

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## Zadání úlohy Testování stavového automatu

Navrhňte charakterizační množinu pro následující konečný deterministický automat. Stavů jsou identifikovány prefixem "s", události prefixem "e", výstupní symboly prefixem "o". Nedosažitelné části automatu identifikujte jako chybu a při konstrukci charakterizační množiny nedosažitelné stavy neuvažujte. Jestliže přechod z nějakého stavu není pro danou událost určen, zůstává automat ve stejném stavu a na výstup pošle předdefinovaný výstupní symbol (default output).

```
entry node: s96
exit node: s49
default output: o54
transition: s67 -> e38/o54 -> s42
transition: s72 -> e20/o54 -> s11
transition: s71 -> e8/o87 -> s1
transition: s27 -> e38/o54 -> s14
transition: s71 -> e38/o87 -> s96
transition: s11 -> e38/o54 -> s72
transition: s42 -> e20/o54 -> s11
transition: s8 -> e8/o54 -> s10
transition: s14 -> e20/o54 -> s11
transition: s96 -> e38/o87 -> s14
transition: s8 -> e20/o87 -> s72
transition: s1 -> e8/o54 -> s10
transition: s11 -> e8/o54 -> s11
transition: s10 -> e8/o87 -> s49
transition: s11 -> e20/o54 -> s49
transition: s10 -> e38/o87 -> s11
transition: s42 -> e38/o54 -> s20
transition: s87 -> e20/o87 -> s64
transition: s49 -> e38/o54 -> s42
transition: s49 -> e20/o87 -> s8
transition: s1 -> e20/o54 -> s87
transition: s72 -> e8/o54 -> s42
transition: s27 -> e20/o54 -> s10
transition: s27 -> e8/o87 -> s96
transition: s14 -> e38/o87 -> s67
transition: s49 -> e8/o87 -> s71
transition: s67 -> e8/o54 -> s71
transition: s67 -> e20/o87 -> s87
transition: s64 -> e38/o54 -> s72
transition: s71 -> e20/o87 -> s87
transition: s72 -> e38/o87 -> s27
transition: s87 -> e38/o87 -> s49
transition: s42 -> e8/o87 -> s64
transition: s96 -> e8/o54 -> s72
transition: s87 -> e8/o87 -> s42
transition: s20 -> e38/o54 -> s14
transition: s10 -> e20/o54 -> s72
transition: s64 -> e20/o54 -> s1
transition: s8 -> e38/o87 -> s20
transition: s64 -> e8/o54 -> s10
transition: s1 -> e38/o54 -> s71
transition: s96 -> e20/o54 -> s72
transition: s20 -> e8/o54 -> s96
transition: s14 -> e8/o54 -> s71
transition: s20 -> e20/o87 -> s20
```



obrázek 1 - zadaný graf

### Charakterizační množina

$$W = \{ (e_0, e_0), (e_0, e_2), (e_0, e_3), (e_0), (e_2, e_0), (e_2), (e_3) \}$$

|                   |                |                   |
|-------------------|----------------|-------------------|
| (s01,s08): e20    | (s08,s14): e20 | (s10,s49): e20    |
| (s01,s10): e08    | (s08,s20): e38 | (s10,s64): e08    |
| (s01,s11): e08e08 | (s08,s27): e08 | (s10,s67): e08    |
| (s01,s14): e38    | (s08,s42): e08 | (s10,s71): e20    |
| (s01,s20): e20    | (s08,s49): e08 | (s10,s72): e08    |
| (s01,s27): e08    | (s08,s64): e20 | (s10,s87): e20    |
| (s01,s42): e08    | (s08,s67): e38 | (s10,s96): e08    |
| (s01,s49): e08    | (s08,s71): e08 | (s11,s14): e38    |
| (s01,s64): e20e08 | (s08,s72): e20 | (s11,s20): e20    |
| (s01,s67): e20    | (s08,s87): e08 | (s11,s27): e08    |
| (s01,s71): e08    | (s08,s96): e20 | (s11,s42): e08    |
| (s01,s72): e38    | (s10,s11): e08 | (s11,s49): e08    |
| (s01,s87): e08    | (s10,s14): e08 | (s11,s64): e08e08 |
| (s01,s96): e38    | (s10,s20): e08 | (s11,s67): e20    |
| (s08,s10): e08    | (s10,s27): e38 | (s11,s71): e08    |
| (s08,s11): e20    | (s10,s42): e38 | (s11,s72): e38    |

|                   |                   |                   |
|-------------------|-------------------|-------------------|
| (s11,s87): e08    | (s20,s87): e08    | (s49,s71): e38    |
| (s11,s96): e38    | (s20,s96): e20    | (s49,s72): e08    |
| (s14,s20): e20    | (s27,s42): e08e38 | (s49,s87): e38    |
| (s14,s27): e08    | (s27,s49): e20    | (s49,s96): e08    |
| (s14,s42): e08    | (s27,s64): e08    | (s64,s67): e20    |
| (s14,s49): e08    | (s27,s67): e08    | (s64,s71): e08    |
| (s14,s64): e38    | (s27,s71): e20    | (s64,s72): e38    |
| (s14,s67): e20    | (s27,s72): e08    | (s64,s87): e08    |
| (s14,s71): e08    | (s27,s87): e20    | (s64,s96): e38    |
| (s14,s72): e08e20 | (s27,s96): e08    | (s67,s71): e08    |
| (s14,s87): e08    | (s42,s49): e20    | (s67,s72): e20    |
| (s14,s96): e08e08 | (s42,s64): e08    | (s67,s87): e08    |
| (s20,s27): e08    | (s42,s67): e08    | (s67,s96): e20    |
| (s20,s42): e08    | (s42,s71): e20    | (s71,s72): e08    |
| (s20,s49): e08    | (s42,s72): e08    | (s71,s87): e08e08 |
| (s20,s64): e20    | (s42,s87): e20    | (s71,s96): e08    |
| (s20,s67): e08e08 | (s42,s96): e08    | (s72,s87): e08    |
| (s20,s71): e08    | (s49,s64): e08    | (s72,s96): e08e08 |
| (s20,s72): e20    | (s49,s67): e08    | (s87,s96): e08    |

## Output traces

---

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| s01 -> (e08): o54         | s11 -> (e08 e20): o54,o54 | s27 -> (e08 e08): o87,o54 |
| s01 -> (e20): o54         | s11 -> (e08 e38): o54,o54 | s42 -> (e08): o87         |
| s01 -> (e20 e08): o54,o87 | s11 -> (e38): o54         | s42 -> (e20): o54         |
| s01 -> (e08 e20): o54,o54 | s11 -> (e08 e08): o54,o54 | s42 -> (e20 e08): o54,o54 |
| s01 -> (e08 e38): o54,o87 | s14 -> (e08): o54         | s42 -> (e08 e20): o87,o54 |
| s01 -> (e38): o54         | s14 -> (e20): o54         | s42 -> (e08 e38): o87,o54 |
| s01 -> (e08 e08): o54,o87 | s14 -> (e20 e08): o54,o54 | s42 -> (e38): o54         |
| s08 -> (e08): o54         | s14 -> (e08 e20): o54,o87 | s42 -> (e08 e08): o87,o54 |
| s08 -> (e20): o87         | s14 -> (e08 e38): o54,o87 | s49 -> (e08): o87         |
| s08 -> (e20 e08): o87,o54 | s14 -> (e38): o87         | s49 -> (e20): o87         |
| s08 -> (e08 e20): o54,o54 | s14 -> (e08 e08): o54,o87 | s49 -> (e20 e08): o87,o54 |
| s08 -> (e08 e38): o54,o87 | s20 -> (e08): o54         | s49 -> (e08 e20): o87,o87 |
| s08 -> (e38): o87         | s20 -> (e20): o87         | s49 -> (e08 e38): o87,o87 |
| s08 -> (e08 e08): o54,o87 | s20 -> (e20 e08): o87,o54 | s49 -> (e38): o54         |
| s10 -> (e08): o87         | s20 -> (e08 e20): o54,o54 | s49 -> (e08 e08): o87,o87 |
| s10 -> (e20): o54         | s20 -> (e08 e38): o54,o87 | s64 -> (e08): o54         |
| s10 -> (e20 e08): o54,o54 | s20 -> (e38): o54         | s64 -> (e20): o54         |
| s10 -> (e08 e20): o87,o87 | s20 -> (e08 e08): o54,o54 | s64 -> (e20 e08): o54,o54 |
| s10 -> (e08 e38): o87,o54 | s27 -> (e08): o87         | s64 -> (e08 e20): o54,o54 |
| s10 -> (e38): o87         | s27 -> (e20): o54         | s64 -> (e08 e38): o54,o87 |
| s10 -> (e08 e08): o87,o87 | s27 -> (e20 e08): o54,o87 | s64 -> (e38): o54         |
| s11 -> (e08): o54         | s27 -> (e08 e20): o87,o54 | s64 -> (e08 e08): o54,o87 |
| s11 -> (e20): o54         | s27 -> (e08 e38): o87,o87 | s67 -> (e08): o54         |
| s11 -> (e20 e08): o54,o87 | s27 -> (e38): o54         | s67 -> (e20): o87         |

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| s67 -> (e20 e08): o87,o87 | s71 -> (e08 e08): o87,o54 | s87 -> (e08 e20): o87,o54 |
| s67 -> (e08 e20): o54,o87 | s72 -> (e08): o54         | s87 -> (e08 e38): o87,o54 |
| s67 -> (e08 e38): o54,o87 | s72 -> (e20): o54         | s87 -> (e38): o87         |
| s67 -> (e38): o54         | s72 -> (e20 e08): o54,o54 | s87 -> (e08 e08): o87,o87 |
| s67 -> (e08 e08): o54,o87 | s72 -> (e08 e20): o54,o54 | s96 -> (e08): o54         |
| s71 -> (e08): o87         | s72 -> (e08 e38): o54,o54 | s96 -> (e20): o54         |
| s71 -> (e20): o87         | s72 -> (e38): o87         | s96 -> (e20 e08): o54,o54 |
| s71 -> (e20 e08): o87,o87 | s72 -> (e08 e08): o54,o87 | s96 -> (e08 e20): o54,o54 |
| s71 -> (e08 e20): o87,o54 | s87 -> (e08): o87         | s96 -> (e08 e38): o54,o87 |
| s71 -> (e08 e38): o87,o54 | s87 -> (e20): o87         | s96 -> (e38): o87         |
| s71 -> (e38): o87         | s87 -> (e20 e08): o87,o54 | s96 -> (e08 e08): o54,o54 |

State cover set

---

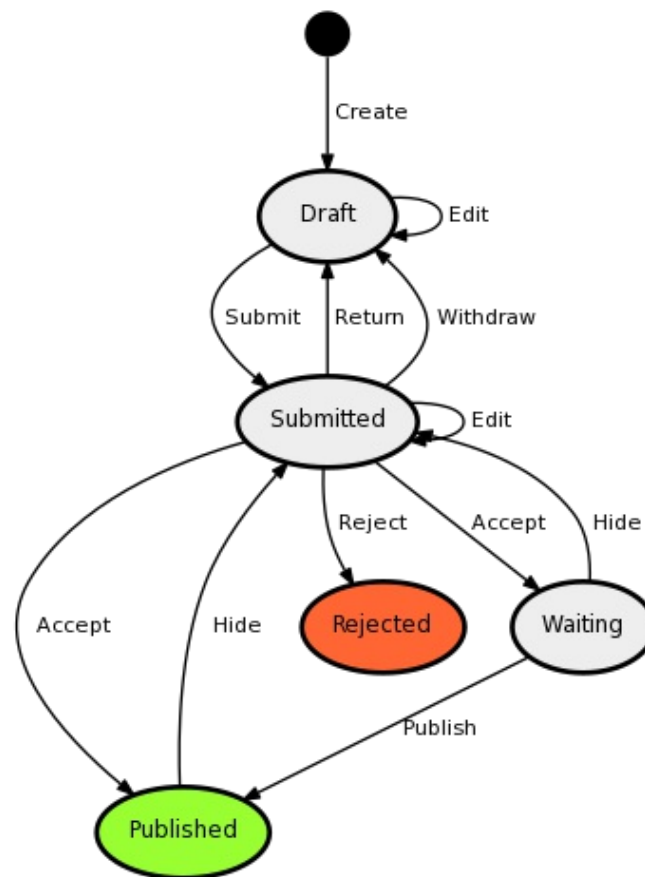
{(e08 e08 e08), (e08 e08 e38), (e08 e08), (e08 e20 e20 e20), (e08 e20 e20), (e08 e20), (e08 e38 e20), (e08 e38), (e08), (e38 e08 e08), (e38 e08 e20), (e38 e08), (e38 e38), (e38)}

Transition cover set

---

{(e08 e08 e08 e08), (e08 e08 e08 e20), (e08 e08 e08 e38), (e08 e08 e08), (e08 e08 e20), (e08 e08 e38 e08), (e08 e08 e38 e20), (e08 e08 e38 e38), (e08 e08 e38), (e08 e08), (e08 e20 e08), (e08 e20 e20 e08), (e08 e20 e20 e20 e08), (e08 e20 e20 e20 e20), (e08 e20 e20 e20 e38), (e08 e20 e20 e20), (e08 e20 e20 e38), (e08 e20 e20), (e08 e20 e38), (e08 e20), (e08 e38 e08), (e08 e38 e20 e08), (e08 e38 e20 e20), (e08 e38 e20 e38), (e08 e38 e20), (e08 e38 e38), (e08 e38), (e08), (e20), (e38 e08 e08 e08), (e38 e08 e08 e20), (e38 e08 e08 e38), (e38 e08 e08), (e38 e08 e20 e08), (e38 e08 e20 e20), (e38 e08 e20 e38), (e38 e08 e20), (e38 e08 e38), (e38 e08), (e38 e20), (e38 e38 e08), (e38 e38 e20), (e38 e38 e38), (e38 e38), (e38)}

## Úloha Články redakčního systému



obrázek 2 - zadaný graf stavů článku v redakčním systému

```

entry state: Draft
exit state: Draft
default output: noop
transition: Waiting -> Accept/Waiting -> Waiting
transition: Draft -> Hide/Submitted -> Submitted
transition: Submitted -> Publish/Published -> Published
transition: Waiting -> Accept/Published -> Published
transition: Draft -> Hide/Submitted -> Submitted
transition: Submitted -> Publish/Published -> Published
transition: Published -> Edit/Draft -> Draft
transition: Waiting -> Accept/Published -> Published
transition: Published -> Edit/Submitted -> Submitted
transition: Draft -> Hide/Submitted -> Submitted
transition: Rejected -> Reject/Rejected -> Rejected
transition: Rejected -> Reject/Rejected -> Rejected

```

## Charakterizační množina

$W = \{(Accept), (Edit)\}$

```

(Draft, Published): Accept
(Draft, Rejected): Accept
(Draft, Submitted): Accept
(Draft, Waiting): Accept
(Published, Rejected): Accept
(Published, Submitted): Edit
(Published, Waiting): Accept
(Rejected, Submitted): Accept
(Rejected, Waiting): Accept
(Submitted, Waiting): Accept

```

## Output traces

---

```
Draft -> (Accept): noop
Draft -> (Edit): Edit/Draft
Published -> (Accept): noop
Published -> (Edit): noop
Rejected -> (Accept): noop
Rejected -> (Edit): noop
Submitted -> (Accept): Accept/Published
Submitted -> (Edit): Edit/Submitted
Waiting -> (Accept): noop
Waiting -> (Edit): noop
```

## State cover set

---

```
{(), (Submit Accept), (Submit Reject), (Submit)}
```

## Transition cover set

---

```
{(Accept), (Edit), (Hide), (Publish), (Reject), (Return), (Submit Accept Accept), (Submit Accept Edit), (Submit Accept Hide), (Submit Accept Publish), (Submit Accept Reject), (Submit Accept Return), (Submit Accept Submit), (Submit Accept Withdraw), (Submit Accept), (Submit Edit), (Submit Hide), (Submit Publish), (Submit Reject Accept), (Submit Reject Edit), (Submit Reject Hide), (Submit Reject Publish), (Submit Reject Reject), (Submit Reject Return), (Submit Reject Submit), (Submit Reject Withdraw), (Submit Reject), (Submit Return), (Submit Submit), (Submit Withdraw), (Submit), (Withdraw)}
```

## Použitý algoritmus

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Pro řešení úlohy jsme v jazyce Scala implementovali algoritmus z přednášky (chapter-3.ppt) s využitím k-ekvivalencí. Zdrojové kódy jsou přiloženy ke zprávě.