

Zadání 1. úkolu do předmětu IZU

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Pomocí metody A* najdete nejkratší cestu v mapě složené z pravidelných buněk, kde cena přechodu mezi dvěma stavy (buněkami) je dána číslem, uvedeným v Tabulce 1 (a je stejná pro všechny přechody ze sousedních míst do příslušné buňky). Nepřekročitelné buňky mají hodnotu "Z" (jako "zeď"). Po každém kroku vypíšte nové hodnoty seznamů Open a Closed. Do pomocné tabulky s ohodnocením uzlů zapisujte aktuálně zkoumaný uzel, cenu cesty do aktuálního uzlu „g“, heuristiku „h“ a celkovou cenu cesty „f“. Heuristiku počítejte jako přímou vzdálenost středů dvou buněk, kde velikost strany jedné buňky je rovna jedné. Uzly generujte v pořadí zleva doprava a shora dolů, uvažujte 8-okolí buňky (tzn. operátory $\nwarrow, \uparrow, \nearrow, \leftarrow, \rightarrow, \swarrow, \downarrow, \searrow$). Výslednou cestu zapište do tabulky Výsledná cesta. Uzel se skládá ze souřadnic, z ohodnocení f a souřadnic uzlu, ze kterého byl vygenerován nebo z operátoru, který byl použit (aby bylo možné nalézt cestu od startu k cíli).

Uzly zapisujte: ([sloupec, řádek], celkové ohodnocení f, [souřadnice otcovského uzlu nebo operátor])

Start: ([6, 4], 5.0, [null])

Cíl: ([3, 8], X, [?, ?])

Výsledná cesta:

| | | | | |
|--------|--------|--------|--------|--------|
| [6, 4] | [5, 4] | [4, 5] | [5, 6] | [4, 7] |
| [3, 8] | | | | |
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| y/x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|---|---|---|---|---|---|---|---|---|---|
| 0 | 8 | 9 | 9 | 9 | 9 | 3 | 9 | 6 | 7 | 8 |
| 1 | 9 | 9 | 7 | 6 | 3 | 7 | 9 | 8 | 9 | 9 |
| 2 | 9 | 9 | 9 | 9 | 3 | 9 | 8 | 7 | 7 | 8 |
| 3 | 9 | 9 | Z | 9 | 3 | 7 | 8 | Z | 8 | 7 |
| 4 | 9 | 9 | Z | 9 | 3 | 4 | 2 | Z | 7 | 7 |
| 5 | 9 | 9 | Z | 8 | 3 | 9 | 9 | Z | 8 | 9 |
| 6 | Z | Z | Z | Z | Z | 3 | Z | Z | Z | Z |
| 7 | 7 | 9 | Z | 6 | 4 | 3 | 8 | 7 | 5 | 8 |
| 8 | 6 | 9 | Z | 2 | 5 | 3 | 8 | 5 | 7 | 8 |
| 9 | 8 | 9 | Z | Z | Z | 3 | 9 | 6 | 7 | 8 |

Tabulka 1: Mapa přechodů. Např. cena přechodu do cílové buňky je rovna 2 pro všechny buňky s cílovou buňkou sousedící.

Pomocná tabulka:

| | Uzel | g | h | f | | Uzel | g | h | f |
|-----|--------|-------|------|-------|-----|--------|-------|------|-------|
| 01. | [6, 4] | 0 | 5.0 | 5.0 | 16. | [5, 2] | 16.00 | 6.32 | 22.32 |
| 02. | [5, 3] | 7.00 | 5.39 | 12.39 | 17. | [6, 2] | 15.00 | 6.71 | 21.71 |
| 03. | [6, 3] | 8.00 | 5.83 | 13.83 | 18. | [4, 7] | 14.00 | 1.41 | 15.41 |
| 04. | [5, 4] | 4.00 | 4.47 | 8.47 | 19. | [5, 7] | 13.00 | 2.24 | 15.24 |
| 05. | [5, 5] | 9.00 | 3.61 | 12.61 | 20. | [6, 7] | 18.00 | 3.16 | 21.16 |
| 06. | [6, 5] | 9.00 | 4.24 | 13.24 | 21. | [7, 2] | 15.00 | 7.21 | 22.21 |
| 07. | [4, 3] | 7.00 | 5.10 | 12.10 | 22. | [4, 8] | 18.00 | 1.00 | 19.00 |
| 08. | [4, 4] | 7.00 | 4.12 | 11.12 | 23. | [5, 8] | 16.00 | 2.00 | 18.00 |
| 09. | [4, 5] | 7.00 | 3.16 | 10.16 | 24. | [6, 8] | 21.00 | 3.00 | 24.00 |
| 10. | [3, 4] | 16.00 | 4.00 | 20.00 | 25. | [3, 7] | 20.00 | 1.00 | 21.00 |
| 11. | [3, 5] | 15.00 | 3.00 | 18.00 | 26. | [3, 8] | 16.00 | 0.00 | 16.00 |
| 12. | [5, 6] | 10.00 | 2.83 | 12.83 | 27. | | | | |
| 13. | [3, 3] | 16.00 | 5.00 | 21.00 | 28. | | | | |
| 14. | [3, 2] | 16.00 | 6.00 | 22.00 | 29. | | | | |
| 15. | [4, 2] | 10.00 | 6.08 | 16.08 | 30. | | | | |

1. iterace

Open:

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| [6, 4], 5.0, NULL | | | | |
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2. iterace

Open:

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|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|
| [5, 3], 12.39, [6, 4] | [6, 3], 13.83, [6, 4] | [5, 4], 8.47, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] |
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Closed:

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| [6, 4], 5.00, NULL | | | | |
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3. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [5, 3], 12.39, [6, 4] | [6, 3], 13.83, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] | [4, 3], 12.10, [5, 4] |
| [4, 4], 11.12, [5, 4] | [4, 5], 10.16, [5, 4] | | | |
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Closed:

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|--------------------|----------------------|--|--|--|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | | | |
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4. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [5, 3], 12.39, [6, 4] | [6, 3], 13.83, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] | [4, 3], 12.10, [5, 4] |
| [4, 4], 11.12, [5, 4] | [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [5, 6], 12.83, [4, 5] | |
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Closed:

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|--------------------|----------------------|-----------------------|--|--|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | | |
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5. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [5, 3], 12.39, [6, 4] | [6, 3], 13.83, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] | [4, 3], 12.10, [5, 4] |
| [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [5, 6], 12.83, [4, 5] | [3, 3], 21.00, [4, 4] | |
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Closed:

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|--------------------|----------------------|-----------------------|-----------------------|--|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | |
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6. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [5, 3], 12.39, [6, 4] | [6, 3], 13.83, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] | [3, 4], 20.00, [4, 5] |
| [3, 5], 18.00, [4, 5] | [5, 6], 12.83, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] |
| [5, 2], 22.32, [4, 3] | | | | |
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Closed:

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|--------------------|----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
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7. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 3], 13.83, [6, 4] | [5, 5], 12.61, [6, 4] | [6, 5], 13.24, [6, 4] | [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] |
| [5, 6], 12.83, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] | [5, 2], 22.32, [4, 3] |
| [6, 2], 21.71, [5, 3] | | | | |
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Closed:

| | | | | |
|-----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | | | | |
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8. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 3], 13.83, [6, 4] | [6, 5], 13.24, [6, 4] | [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [5, 6], 12.83, [4, 5] |
| [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] | [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] |
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Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | | | |
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9. iterace

Open:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 3], 13.83, [6, 4] | [6, 5], 13.24, [6, 4] | [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [3, 3], 21.00, [4, 4] |
| [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] | [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] | [4, 7], 15.41, [5, 6] |
| [5, 7], 15.24, [5, 6] | [6, 7], 21.16, [5, 6] | | | |
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Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, NULL | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | [5, 6], 12.83, [4, 5] | | |
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10. iterace

Open:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 3], 13.83, [6, 4] | [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] |
| [4, 2], 16.08, [4, 3] | [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] | [4, 7], 15.41, [5, 6] | [5, 7], 15.24, [5, 6] |
| [6, 7], 21.16, [5, 6] | | | | |
| | | | | |

Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, [NULL] | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | [5, 6], 12.83, [4, 5] | [6, 5], 13.24, [6, 4] | |
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11. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] |
| [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] | [4, 7], 15.41, [5, 6] | [5, 7], 15.24, [5, 6] | [6, 7], 21.16, [5, 6] |
| [7, 2], 22.21, [6, 3] | | | | |
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Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, [NULL] | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | [5, 6], 12.83, [4, 5] | [6, 5], 13.24, [6, 4] | [6, 3], 13.83, [6, 4] |
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12. iterace

Open:

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|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] |
| [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] | [4, 7], 15.41, [5, 6] | [6, 7], 21.16, [5, 6] | [7, 2], 22.21, [6, 3] |
| [4, 8], 19.00, [5, 7] | [5, 8], 18.00, [5, 7] | [6, 8], 24.00, [5, 7] | | |
| | | | | |

Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, [NULL] | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | [5, 6], 12.83, [4, 5] | [6, 5], 13.24, [6, 4] | [6, 3], 13.83, [6, 4] |
| [5, 7], 15.24, [5, 6] | | | | |
| | | | | |

13. iterace

Open:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [3, 4], 20.00, [4, 5] | [3, 5], 18.00, [4, 5] | [3, 3], 21.00, [4, 4] | [3, 2], 22.00, [4, 3] | [4, 2], 16.08, [4, 3] |
| [5, 2], 22.32, [4, 3] | [6, 2], 21.71, [5, 3] | [6, 7], 21.16, [5, 6] | [7, 2], 22.21, [6, 3] | [4, 8], 19.00, [5, 7] |
| [5, 8], 18.00, [5, 7] | [6, 8], 24.00, [5, 7] | [3, 7], 21.00, [4, 7] | [3, 8], 16.00, [4, 7] | |
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Closed:

| | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| [6, 4], 5.00, [NULL] | [5, 4], 8.47, [6, 4] | [4, 5], 10.16, [5, 4] | [4, 4], 11.12, [5, 4] | [4, 3], 12.10, [5, 4] |
| [5, 3], 12.39, [6, 4] | [5, 5], 12.61, [6, 4] | [5, 6], 12.83, [4, 5] | [6, 5], 13.24, [6, 4] | [6, 3], 13.83, [6, 4] |
| [5, 7], 15.24, [5, 6] | [4, 7], 15.41, [5, 6] | | | |
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14. iterace

Open:

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15. iterace

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16. iterace

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