

# SINGLE SOURCE SHORTEST PATHS

## Bellman-Ford

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# BELLMAN-FORD VS DIJKSTRA

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- ✗ Complexitate:  $O(VE)$
- ✗ Muchii de cost negativ
- ✗ Mai usor de implementat

# Input:

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- ✗ Graf directionat cu muchii cu cost
- ✗ Un nod sursa

# Output:

- ✗ Cea mai mica distanta catre toti vertecsii
- ✗ Daca se gaseste un ciclu negativ, distantele nu se mai calculeaza si se raporteaza ciclu negativ

# ALGORITHM

- ✗ **procedure** BellmanFord(*list vertices, list edges, vertex source*)
  - + **for each** vertex  $v$  **in** vertices:
    - ✗ **if**  $v$  **is** source **then**  $\text{distance}[v] := 0$
    - ✗ **else**  $\text{distance}[v] := \text{infinity}$ ,  $\text{predecessor}[v] := \text{null}$
  - + **for**  $i$  **from** 1 **to**  $\text{size}(\text{vertices})-1$ :
    - ✗ **for each** edge  $(u, v)$  **with** weight  $w$  **in** edges:
      - ✗ **if**  $\text{distance}[u] + w < \text{distance}[v]$ :  
 $\text{distance}[v] := \text{distance}[u] + w$ ,  $\text{predecessor}[v] := u$
  - + **for each** edge  $(u, v)$  **with** weight  $w$  **in** edges:
    - ✗ **if**  $\text{distance}[u] + w < \text{distance}[v]$ :  
**error** "Graph contains a negative-weight cycle"



**EXEMPLU:**

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EXEMPLU:

# TESTARE

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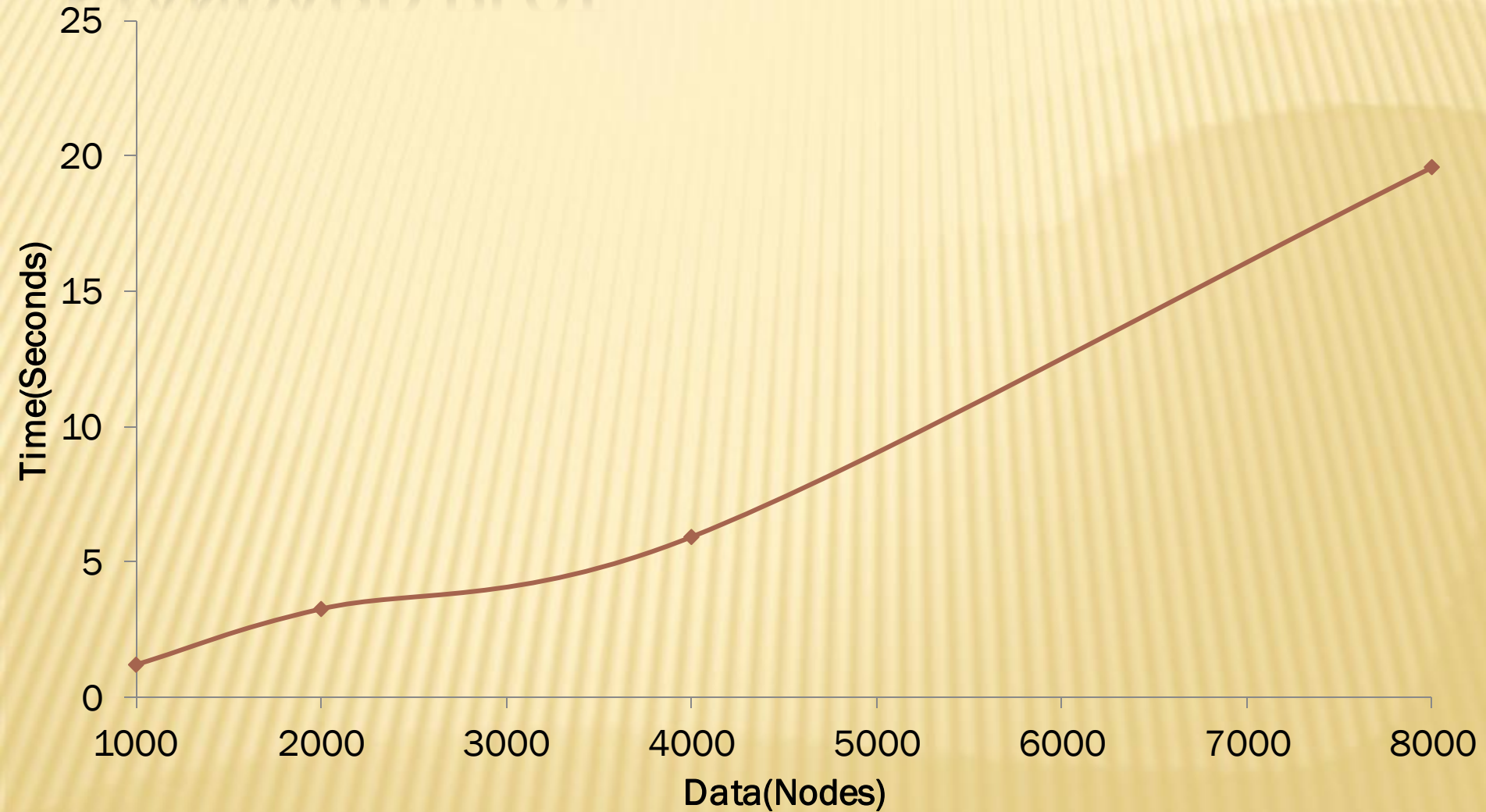
- ✘ Corectitudinea implementarii s-a demonstrat cu ajutorul brute-force-ului.
- ✘ S-a implementat o metoda de gasire a tuturor cailor posibile de la sursa la celalalte noduri cu ajutorul DFS, pentru fiecare nod s-a pastrat cel mai mic rezultat.
- ✘ Graph-ul de test a fost obtinut printr-un generator de grafuri.

# REZULTATE

- ✗ Performantele algoritmului au fost testate prin generarea a 4 grafuri de 1000,2000,4000 si 8000 noduri.
- ✗ Pentru fiecare graph, s-a determinat timpul de rulare.

Noduri	Muchii	Timp(s)
1000	5373	1.197
2000	10986	3.257
4000	22043	5.92
8000	44394	19.593

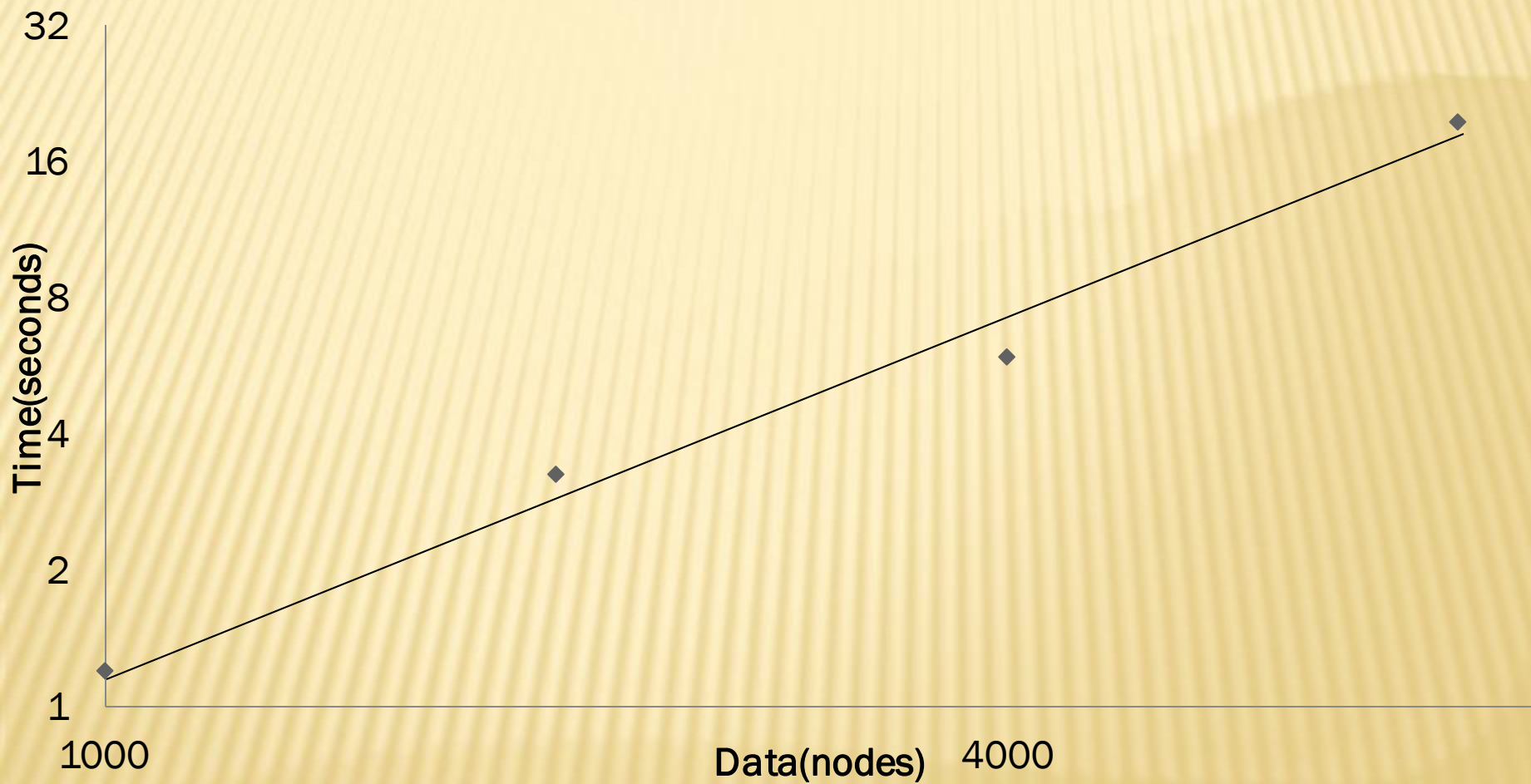
# STANDARD PLOT





# LOG-LOG PLOT

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# REFERINTE

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- × Geeks for geeks
- × Sedgewick Wayne Algorithms 4<sup>th</sup> textbook
- × Wikipedia

# INTREBARI?

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