

373D4122 SISTEM KENDALI OPTIMAL MODUL 3 ROUTING

(versi kuliah DARLING =
semi-DARing semi-LurING)
Semester Akhir 2020-2021

Shortest Path Problem

- Given: network topology with link costs
 - $c(x, y)$: link cost from node x to node y
 - Infinity if x and y are not direct neighbors
- Compute: least-cost paths to all nodes
 - From a given source u to all other nodes.

Step	Cost	Path
1	0	A
2	2	A-B
3	4	A-C
4	6	A-B-D
5	8	A-B-D-E
6	10	A-B-D-E-F
7	12	A-B-D-E-F-G
8	14	A-B-D-E-F-G-H

33. The Dijkstra's shortest path algorithm is widely used in network routing protocols. Given a network of 8 nodes and the distance between each node as shown in the figure below:

Figure Q3.30: Network graph of 8 nodes

34. Find the shortest path tree of node 0 to all the other nodes (node 1 to 8) using Dijkstra's algorithm. (10)

35. Find the shortest path from node 0 to node 8 using Dijkstra's algorithm. (10)

Total: 20

Shortest Path Routing

The first 5 steps used to computing the shortest path from A to D. The arrows indicate the working route.

Node	Shortest Path	Distance
0	0	0
1	0-1	1
2	0-1-2	2
3	0-1-3	3
4	0-1-3-4	4
5	0-1-3-5	5
6	0-1-3-5-6	6

When we start Dijkstra's algorithm, we don't know how far all other vertices are reachable, so the shortest distance from the source node is infinity, ∞.

→ However, we do know the shortest distance of our node (0). Since we are already at 0, our shortest distance, the shortest distance is 0 to 0.

MATERI PERKULIAHAN

- **Bagian 1: Metode OPTIMISASI** (Pekan 1 s/d 8 oleh RHZ)
- **Bagian 2: Sistem Kendali OPTIMAL** (Pekan 9 s/d 16 oleh EJA)

SUMBER PEMBELAJARAN



Index of /rhiza/arsip/kuliah/Sistem-Kendali-Optimal

Name	Last modified	Size	Description
Parent Directory		-	
458D432 Sistem Kendali Optimal.doc	27-Mar-2008 23:21	64K	
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tugas-tugas/	08-Oct-2019 01:00	-	

Website: <https://web.unhas.ac.id/rhiza/arsip/kuliah/Sistem-Kendali-Optimal/>

Catatan Kuliah: [https://web.unhas.ac.id/rhiza/arsip/kuliah/Sistem-Kendali-Optimal/Catatan Kuliah SKO Part 1 OPTIMISASI.pdf](https://web.unhas.ac.id/rhiza/arsip/kuliah/Sistem-Kendali-Optimal/Catatan_Kuliah_SKO_Part_1_OPTIMISASI.pdf)

ROUTING

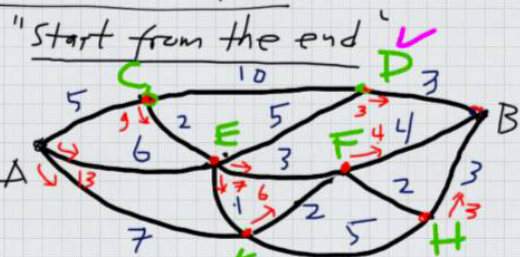
Antara lain ada **3** (tiga) kasus **ROUTING**:

★ **The SHORTEST PATH Problem** (Linear Programming)

★ **The Travelling SALESMAN Problem** (Dynamic Programming)

★ **The Block City Police Patrol Problem** (Dynamic Programming)

* The shortest path →



Tentukan route dari A ke B terdekat

Jalur terdekat 13 km: (1) AEFB
(2) AEGFB
(3) AGFB

Tugas 4.1. Shortest path Kampus Gowa ke Tulare

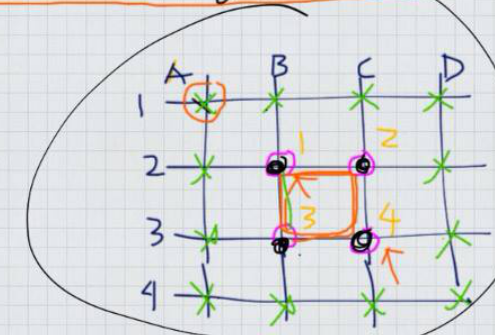
* The Travelling Salesman Problem

Seorang salesman akan berjalan dari A kembali ke A dengan melewati SEMUA kota minimal 1 kali

Tugas 4.2. Tentukan route terpendek untuk seorang "Travelling Salesman" yang berangkat dari Makassar, kembali ke Makassar, dan melewati semua Kota/Kab di Sulsel minimal 1X →

LIHAT Google Map

* Block City Police Patrol Problem



Ada 4 alternatif penempatan polisi, yaitu: B2, C2, B3, atau C3.

Mana yang paling baik?

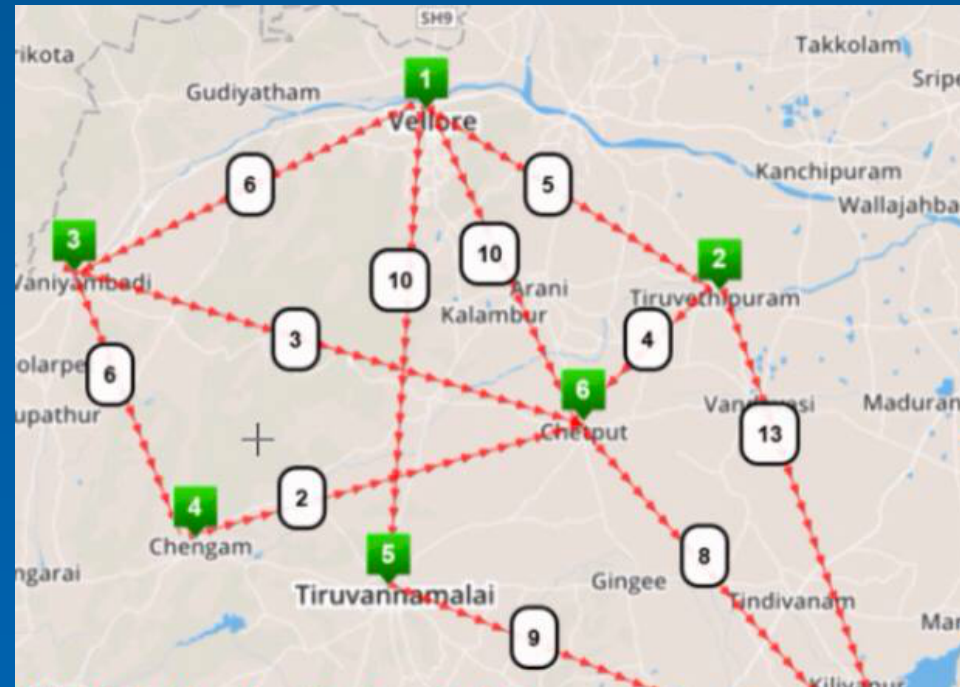
Ada 15 titik tujuan → waktu rata-rata untuk mencapai 15 titik tersebut dari alternatif (1), (2), (3) dan (4).
Tugas 4.3. Karanglah suatu masalah spt di atas!

Untuk **TUGAS 4 (a), (b)** dan **(c)** berikut, **GUNAKAN**:

Google Maps



Tugas 4 (a) The Shortest PATH



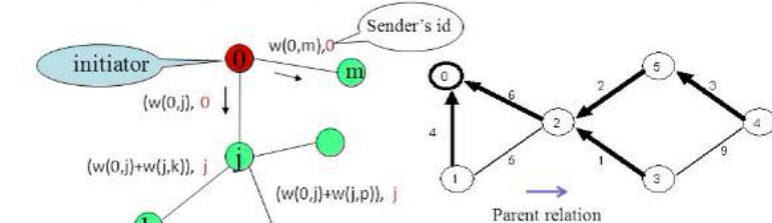
Google Maps



Routing: Shortest Path

Most distributed algorithms for shortest path are adaptations of **Bellman-Ford algorithm**. It computes **single-source** shortest paths in a weighted graphs. Designed for directed graphs. Computes shortest path if there are **no cycle of negative weight**.

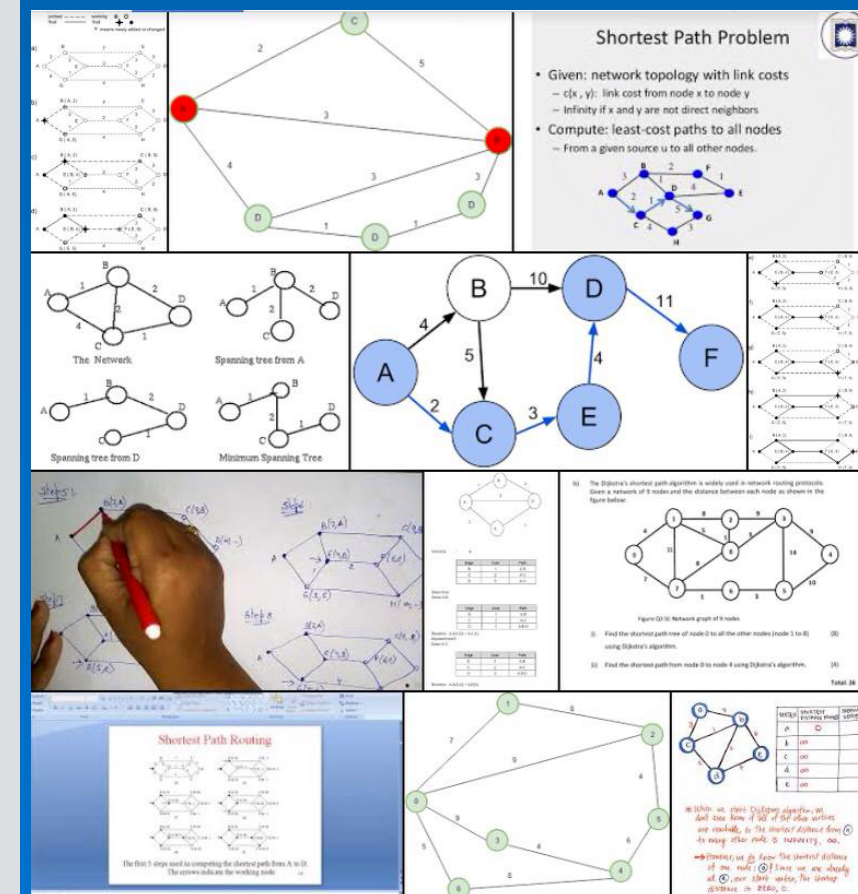
Let $D(j)$ = **shortest distance of node j from initiator 0**. $D(0) = 0$. Initially, $\forall i \neq 0$, $D(i) = \infty$. Let $w(i, j)$ = weight of the edge from node i to node j



The edge weights can represent **latency or distance** or some other appropriate parameter:

Dengan fasilitas **Google Maps**, tentukan beberapa alternatif jalur dari gedung **COT** di Kampus **Gowa** ke **Rektorat** di Kampus **Tamanlana**.

- Tentukan alternatif **jalur yang paling pendek** jaraknya.
- Apakah itu **jalur tercepat** juga?
- Kira2 **algoritma** apa yang digunakan **Google Maps** dalam menentukan jalur-jalur terpendek.
- Coba di-telusuri apakah yang di-dapat oleh **Google Maps** memang sesuai dengan kenyataan (**verifikasi**)



Tugas 4 (b) The Travelling Sales Man

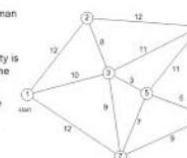
Dengan fasilitas **Google Maps**, tentukan **route** terpendek yang harus ditempuh seorang **salesman** yang berangkat **dari Makassar** dan **kembali ke Makassar** setelah mengunjungi **SEMUA KOTA/KABUPATEN di SULAWESI SELATAN** minimal satu kali.

Google Maps



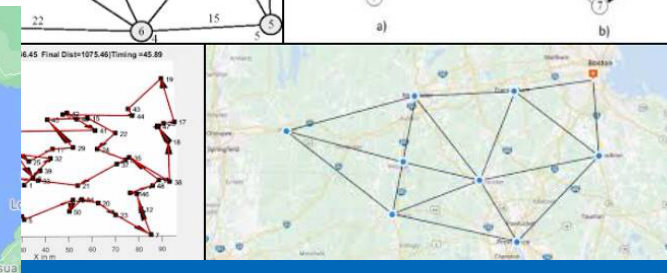
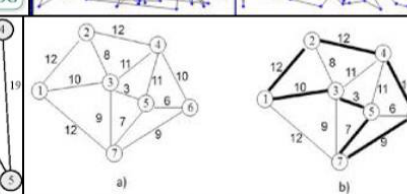
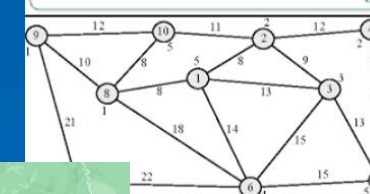
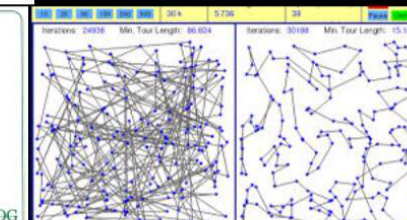
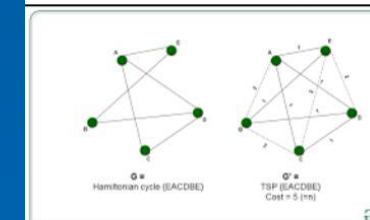
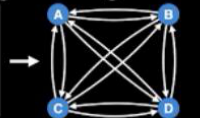
The Traveling Salesman Problem

- Starting from city 1, the salesman must travel to all cities once before returning home
- The distance between each city is given, and is assumed to be the same in both directions
- Only the links shown are to be used
- Objective - Minimize the total distance to be travelled



Traveling Salesman Problem Dynamic Programming

0	4	1	9
3	0	6	11
4	1	0	2
6	5	-4	0



Travelling Salesman Problem using Genetic Algorithm

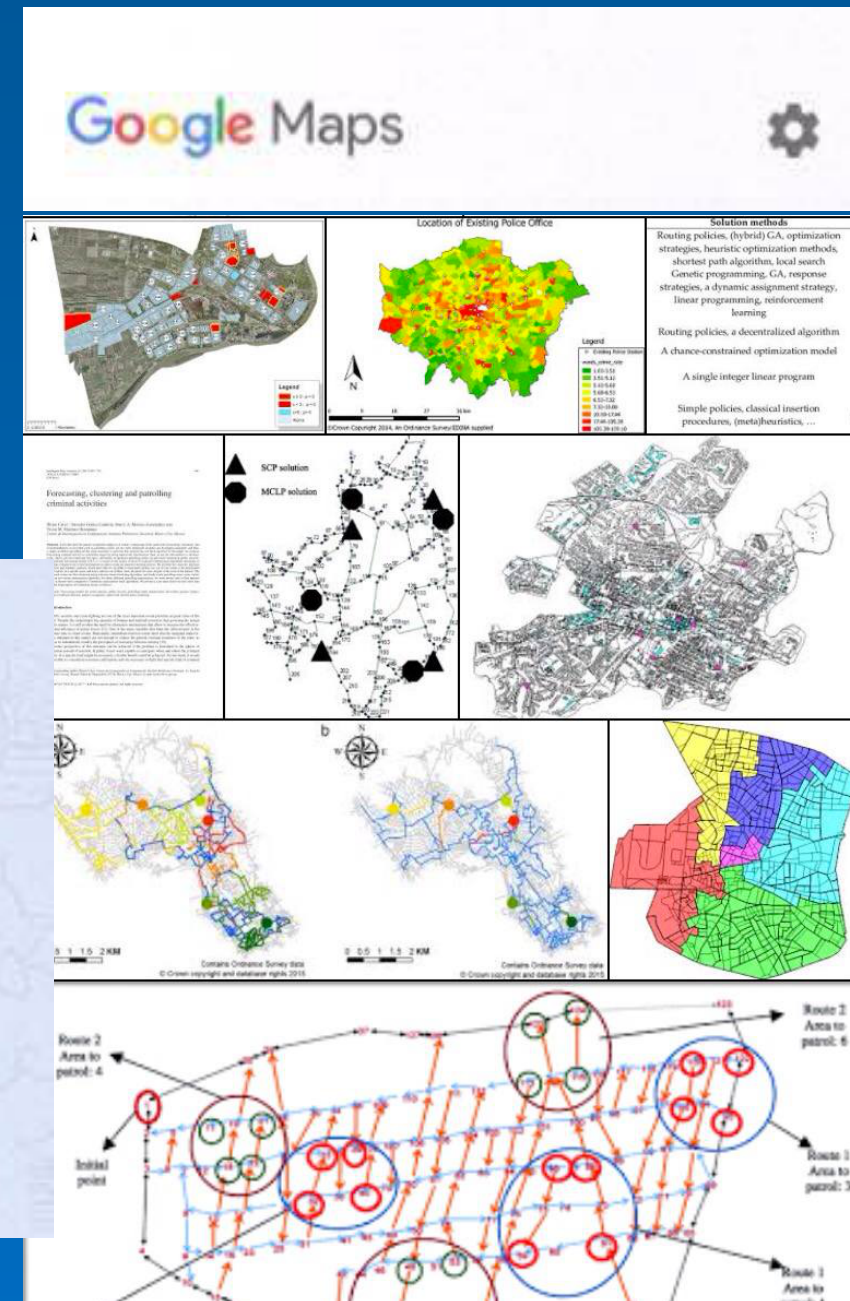
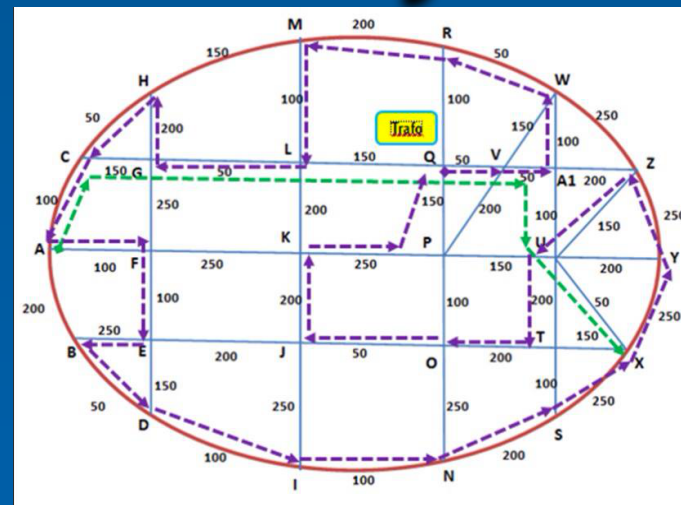
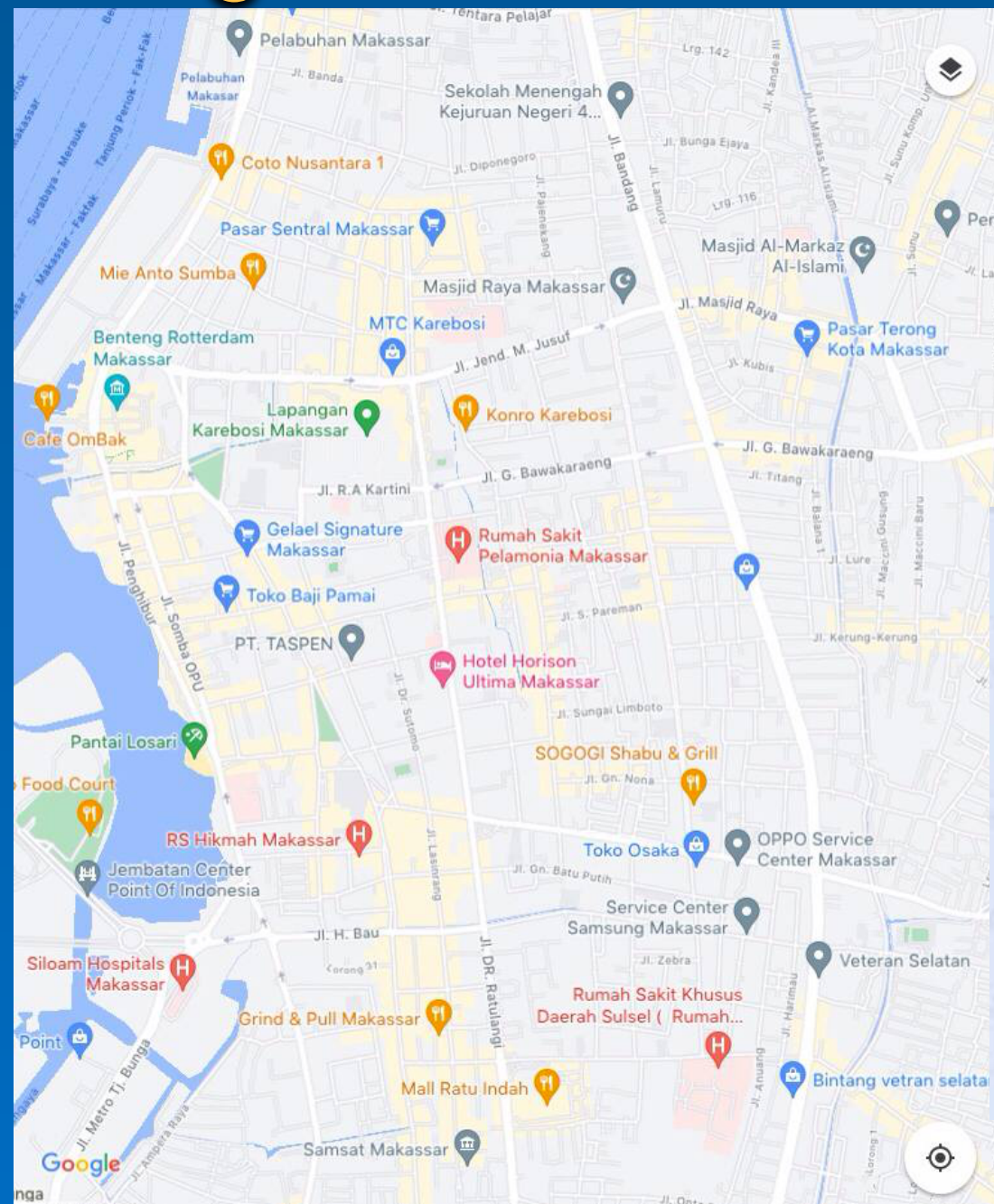
SHIKHA GUPTA
ASSISTANT PROFESSOR
ADVANCED EDUCATIONAL INSTITUTE

THE TRAVELLING SALESMAN PROBLEM
WHAT'S THE SHORTEST ROUTE TO VISIT ALL LOCATIONS AND RETURN?



ADDING MORE STOPS TAKES
LONGER AND LONGER AND LONGER TO FIGURE IT OUT

Tugas 4 (c) The Block City Police Patrol



Dengan fasilitas **Google Maps**, tentukan lokasi **POS POLISI** yang **IDEAL** sehingga dapat menjangkau semua sudut kota **MAKASSAR** dengan cepat.

SUMBER MATERI AJAR

- **ON-LINE:** <https://web.unhas.ac.id/rhiza/arsip/kuliah/Sistem-Kendali-Optimal/>

●●●● Tsel-PakaiMasker 3G 21.08

< >  web.unhas.ac.id 

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- **Buku Ajar:**

1. **Ogata**, Katsuhiko, “Modern Control Engineering”, Prentice Hall of India, New Delhi, atau terjemahannya (jilid 2) terbitan Penerbit Erlangga, Jakarta
2. **Fletcher**, R., “Practical Methods of Optimization”, John Wiley & Sons, Chichester, NY.
3. **Athans**, Michael and Peter L. **Falb**, “Optimal Control”, McGraw-Hill Book Company, NY.

2 (DUA) BAGIAN MATERI KULIAH:

- **Bagian 1: Metode OPTIMISASI**
(Pekan 1 s/d 8 oleh RHZ)

- **Bagian 2:**
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KENDALI
OPTIMAL
(Pekan 9 s/d 16
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MODUL PEMBELAJARAN

- **Bagian 1: Metode OPTIMISASI** (Pekan 1 s/d 8 oleh RHZ)

- **MODUL 0: PENGANTAR KULIAH**
- **MODUL 1: Pengenalan Metode OPTIMISASI**
- **MODUL 2: Pemrograman Linier**
- **MODUL 3: *Routing***
- **MODUL 4: *Searching***

```
graph LR; A[MODUL 0-4] --> B[TUGAS-TUGAS]; B --> C(UJIAN FINAL)
```

TUGAS-TUGAS

UJIAN FINAL

SELAMAT BELAJAR

Semoga SUKSES meraih PRESTASI!

