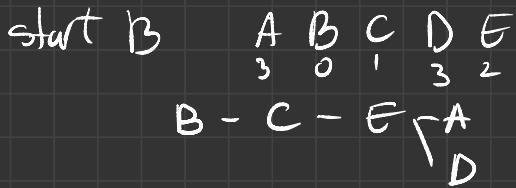
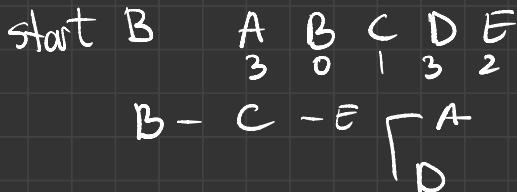


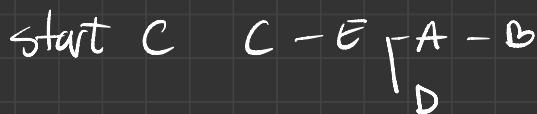
DFT - B



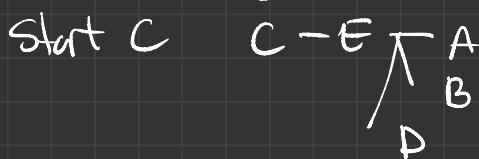
BFT - B



DFT - C A B C D E
 2 3 0 1



BFT - C



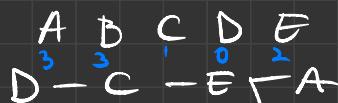
DFT - D



start D D - C - E - A - B

BFT - D

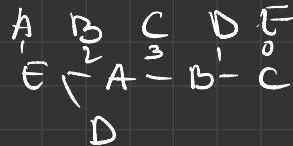
start D



D - C - E A

\ B

DFT - E
start E



$$A : \{(B, 1), (E, 1)\}$$

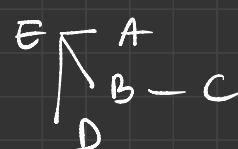
$$B : \{(C, 2)\}$$

BFT - E



$$C : \{(E, 1)\}$$

start E



$$D : \{(C, 3)\}$$

$$E : \{(A, 2), (B, 4), (D, 2)\}$$

2.3 Dijkstra - A

start A

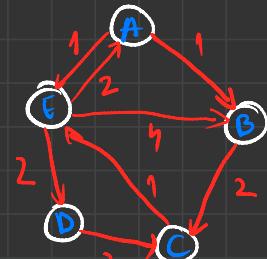


$$Q = \{(B, 1), (E, 1)\} \quad A-B \rightarrow 1$$

$$Q = \{(C, 2+1), (E, 1)\} \quad A-E \rightarrow 1$$

$$Q = \{(D, 2+1), (C, 3)\} \quad A-E-D \rightarrow 3$$

$$Q = \{(C, 3)\} \quad A-B-C \rightarrow 3$$



*

Dijkstra - A



$$Q : \{(D, 5), (E, 1)\} \quad A-E \rightarrow 1$$

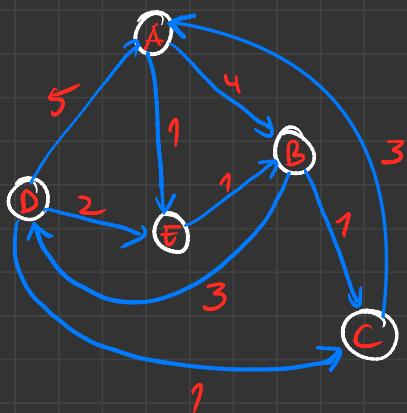
$$Q : \{(C, 4+1), (D, 2+1), (F, 2+1)\} \quad A-E-D \rightarrow 3$$

$$Q : \{(C, 3+1), (F, 3)\} \quad A-E-F \rightarrow 3$$

$$Q: \{(B, 3+3), (C, 3+1)\} \quad A - E - D - C \rightarrow 4$$

$$Q: \{(\underline{B}, 1+4)\} \quad A - E - D - C - B \rightarrow 5$$

*



$$A: \{(B, 4), (E, 1)\}$$

$$B: \{(C, 1), (D, 3)\}$$

$$C: \{(A, 3)\}$$

$$D: \{(A, 5), (C, 1), (E, 2)\}$$

$$E: \{(B, 1)\}$$

Dijkstra - D

A	B	C	D	E
*	*	*	*	*

$$Q: \{(A, 5), (\underline{C}, 1), (E, 2)\} \quad D - C \rightarrow 1$$

$$Q: \{(A, 3+1), (\underline{E}, 2)\} \quad D - E \rightarrow 2$$

$$Q: \{(A, 4), (\underline{B}, 1+2)\} \quad D - E - B \rightarrow 3$$

$$Q: \{(A, 4)\} \quad D - C - A \rightarrow 4$$

Dijkstra - B

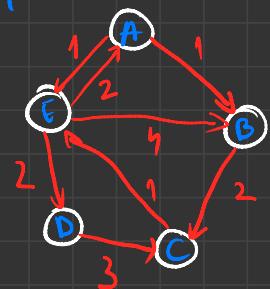
A	B	C	D	E
*	*	*	*	*

$$Q: \{(\underline{C}, 1), (D, 3)\} \quad B - C \rightarrow 1$$

$$Q: \{(A, 3+1), (\underline{D}, 3)\} \quad B - D \rightarrow 3$$

$$Q: \{(A, 4), (E, 2+3)\} \quad B - C - A \rightarrow 4$$

$$Q: \{(E, 5)\} \quad B - C - A - E \rightarrow S$$



$$A: \{(B, 1), (E, 1)\}$$

$$B: \{(C, 2)\}$$

$$C: \{(E, 1)\}$$

$$D: \{(C, 3)\}$$

$$E: \{(A, 2), (B, 4), (D, 2)\}$$

Dijkstra - C

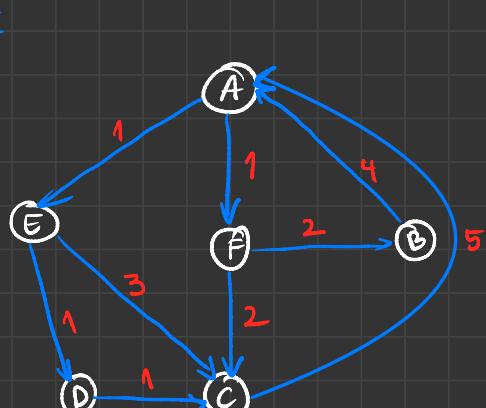
A * B * C * D * E

$$Q: \{(E, 1)\} \quad C - E \rightarrow 1$$

$$Q: \{(A, 2+1), (B, 4+1), (D, 2+1)\} \quad C - E - A \rightarrow 3$$

$$Q: \{(B, 1+3), (D, 3)\} \quad C - E - D \rightarrow 3$$

$$Q: \{(B, 4)\} \quad C - E - A - B \rightarrow 4$$



$$A: \{(E, 1), (F, 1)\}$$

$$B: \{(A, 4)\}$$

$$C: \{(A, 5)\}$$

$$D: \{(C, 1)\}$$

$$E: \{(C, 3), (D, 1)\}$$

$$F: \{(B, 2), (C, 2)\}$$

Dijkstra - B

A	B	C	D	E	F
*	*	*	*	*	*

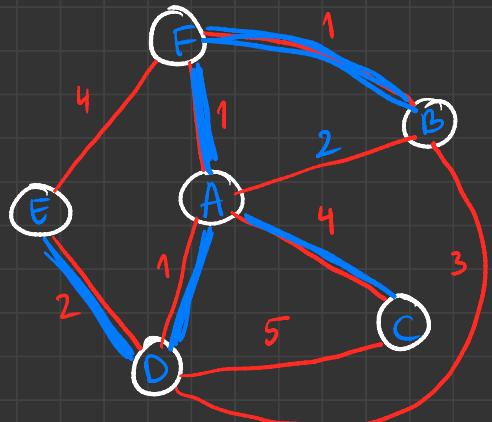
Q: $\{(A, 4)\}$ $B-A \rightarrow 4$

Q: $\{(E, 4), (F, 4)\}$ $B-A-E \rightarrow 5$

Q: $\{(C, 3+5), (D, 1+5), (F, 5)\}$ $B-A-F \rightarrow 5$

Q: $\{(C, 2+5), (D, 6)\}$ $B-A-E-D \rightarrow 6$

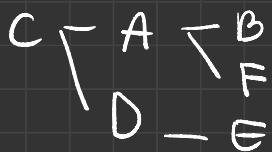
Q: $\{(C, 6+1)\}$ $B-A-E-D-C \rightarrow 7$



	A	B	C	D	E	F
A	0	2	4	1	∞	1
B	2	0	∞	3	∞	1
C	4	∞	0	5	∞	∞
D	1	3	5	0	2	∞
E	∞	∞	∞	2	0	4
F	1	1	∞	∞	4	0

BFT - C

A	B	C	D	E	F
*	*	*	*	*	*



$PRIM - C$

$A \quad B \quad C \quad D \quad E \quad F$

$Q: \{(A, 4), (D, 5)\}$

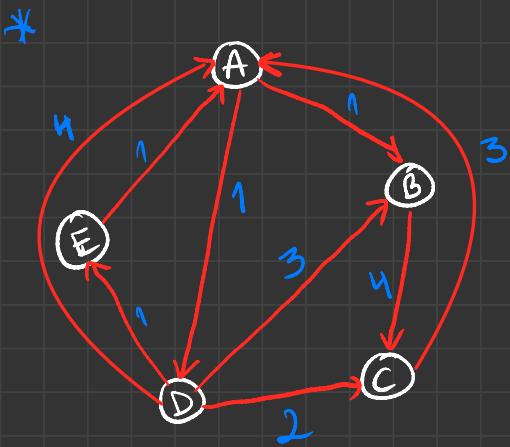
$A \ Q: \{(B, 2), (\underline{D, 1}), (F, 1)\} \quad A - D \rightarrow 1$

$D \ Q: \{(B, 2), (E, 2), (\underline{F, 1})\} \quad A - F \rightarrow 1$

$F \ Q: \{(\underline{B, 1}), (E, 2)\} \quad F - B \rightarrow 1$

$B \ Q: \{(E, 2)\} \quad D - E \rightarrow 2$

$$CT = 9$$



$A: \{(B, 1), (D, 1)\}$

$B: \{(C, 4)\}$

$C: \{(A, 3)\}$

$D: \{(B, 3), (E, 1), (A, 4), (C, 2)\}$

$$E: \{(A, 9)\}$$

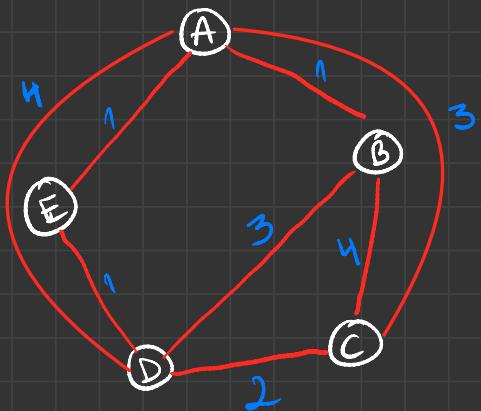
Dijkstra C A B C D E
 * * * * *

$Q: \{(\underline{A}, 3)\}$ C-A $\rightarrow 3$

$Q: \{(\underline{B}, 1+3), (\underline{D}, 1+3)\}$ C-A-B $\rightarrow 4$

$Q: \{(\underline{D}, 4)\}$ C-A-D $\rightarrow 4$

$Q: \{(\underline{E}, 1+4)\}$ C-A-D-E $\rightarrow 5$



$$A: \{(B, 1), (C, 3), (D, 4), (E, 1)\}$$

$$B: \{(C, 4), (D, 3), (A, 1)\}$$

$$C: \{(A, 3), (B, 4), (D, 2)\}$$

$$D: \{(A, 4), (B, 3), (C, 2), (E, 1)\}$$

$$E: \{(A, 1), (D, 1)\}$$

PRIM - C A B C D E
 * * * * *

$Q: \{(A, 3), (B, 4), (\underline{D}, 2)\}$ C-D $\rightarrow 2$

$Q: \{(A, 3), (B, 3), (\underline{E}, 1)\}$ D-E $\rightarrow 1$

$Q: \{(\underline{A}, 1), (B, 3)\}$ E-A $\rightarrow 1$

$Q: \{ (B, 1) \}$

$$\frac{A-B \rightarrow 1}{CT = 5}$$

PRIM - A

A	B	C	D	E
*	*		*	*

$Q: \{ (B, 1), (C, 3), (D, 4), (E, 1) \} \quad A-B \rightarrow 1$

$Q: \{ (C, 3), (D, 3), (E, 1) \} \quad A-E \rightarrow 1$

$Q: \{ (C, 3), (D, 1) \} \quad E-D \rightarrow 1$

$Q: \{ (C, 2) \}$

$$\frac{D-C \rightarrow 2}{CT = 5}$$

PRIM - B

A	B	C	D	E
*	*		*	*

$Q: \{ (C, 4), (D, 3), (A, 1) \} \quad B-A \rightarrow \perp$

$Q: \{ (C, 3), (D, 3), (E, 1) \} \quad A-E \rightarrow \perp$

$Q: \{ (C, 3), (D, 1) \} \quad E-D \rightarrow 1$

$Q: \{ (C, 2) \}$

$$\frac{D-C \rightarrow 2}{CT = 5}$$

PRIM - D

A B C D E

Q: $\{(A,1), (B,3), (C,2), (\underline{E,1})\}$ D

Q: $\{\underline{(A,1)}, (B,3), (C,2)\} \in A \rightarrow 1$

Q: $\{\underline{(B,1)}, (C,2)\} \quad A \rightarrow B \rightarrow 1$

Q: $\{(C,2)\} \quad \frac{D-C \rightarrow 2}{CT=5}$

A: $\{(B,1), (C,3), (D,4), (E,1)\}$

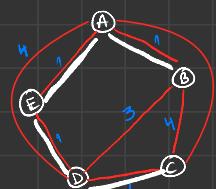
B: $\{(C,4), (D,3), (A,1)\}$

C: $\{(A,3), (B,4), (D,2)\}$

D: $\{(A,4), (B,3), (C,2), (E,1)\}$

E: $\{(A,1), (D,1)\}$

↓



KUSKRAL

A-B	A-E	E-D	D-C	B-D	A-C	A-D
1	1	1	2	3	3	4

A-B → 1

E-D → 1

A-E → 1

D-C → 2

CT = 5

DFT - A

A B C D E

A - B - C - D - E

A: $\{(B,1), (C,3), (D,4), (E,1)\}$

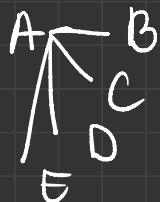
B: $\{(C,4), (D,3), (A,1)\}$

C: $\{(A,3), (B,4), (D,2)\}$

D: $\{(A,4), (B,3), (C,2), (E,1)\}$

E: $\{(A,1), (D,1)\}$

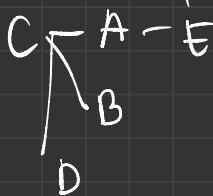
BFT - A A B C D E



DFT - C A B C D E

C - A - B - D - E

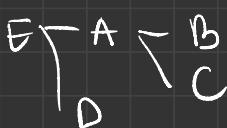
BFT - C A B C D E

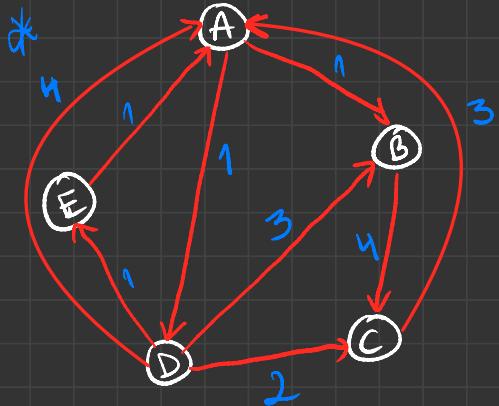


DFT - E A B C D E

E - A - B - C - D

BFT - E A B C D E





	A	B	C	D	E
A	0	1	∞	1	∞
B	∞	0	4	∞	∞
C	3	∞	0	∞	∞
D	4	3	2	0	1
E	1	∞	∞	∞	0

	A	B	C	D	E
A	0	1	∞	1	∞
B	∞	0	4	∞	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	∞	2	0

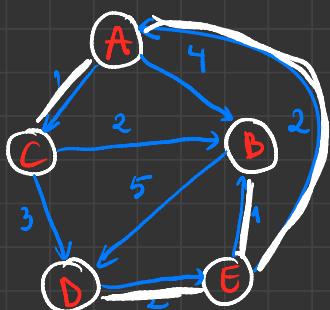
	A	B	C	D	E
A	0	1	5	1	∞
B	∞	0	4	∞	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	5	2	0

	A	B	C	D	E
A	0	1	5	1	∞
B	7	0	4	8	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	5	2	0

	A	B	C	D	E
A	0	1	3	1	2
B	7	0	4	8	9
C	3	4	0	4	5
D	4	3	2	0	1
E	1	2	4	2	0

	A	B	C	D	E
A	0	1	3	1	2
B	7	0	4	8	9
C	3	4	0	4	5
D	2	3	2	0	1
E	1	2	4	2	0

* Test G1



1. $G_{\text{Neorientat}} \rightarrow \text{Prim } D$

2. $G_{\text{Orientat}} \rightarrow \text{Dijkstra } D$

A: $\{(B, 4), (C, 1), (E, 2)\}$

B: $\{(A, 4), (C, 2), (D, 5), (E, 1)\}$

C: $\{(A, 1), (B, 2), (D, 3)\}$

D: $\{(B, 5), (C, 3), (E, 2)\}$

E: $\{(A, 2), (B, 1), (D, 2)\}$

PRIM - D

A B C D E

Q: $\{(B, 5), (C, 3), (E, 2)\}$

$D-E \rightarrow 2$

*

CH-AD

	A	B	C	D	E
A	0	1	∞	1	∞
B	∞	0	4	∞	∞
C	3	∞	0	∞	∞
D	4	3	2	0	1
E	1	∞	∞	∞	0

	A	B	C	D	E
A	0	1	∞	1	∞
B	∞	0	4	∞	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	∞	2	0

	A	B	C	D	E
A	0	1	5	1	∞
B	∞	0	4	∞	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	6	2	0

	A	B	C	D	E
A	0	1	5	1	∞
B	∞	0	4	8	∞
C	3	4	0	4	∞
D	4	3	2	0	1
E	1	2	6	2	0

	A	B	C	D	E
A	0	1	3	1	2
B	7	0	4	8	9
C	3	4	0	4	5
D	4	3	2	0	1
E	1	2	4	2	0

	A	B	C	D	E
A	0	1	3	1	2
B	7	0	4	8	9
C	5	4	0	4	5
D	2	3	2	0	1
E	1	2	4	2	0

*

$Q: \{(A_{1,2}), (\underline{B_{1,1}}), (C_{1,3})\} \quad E-B \rightarrow 1$

$Q: \{\underline{(A_{1,2})}, (C_{1,2})\} \quad E-A \rightarrow 2$

$Q: \{\underline{(C_{1,1})}\} \quad A-C \rightarrow 1$

$$CT = 6$$

$A: \{(B_{1,4}), (C_{1,1})\}$

$B: \{(D_{1,5})\}$

$C: \{(B_{1,2}), (D_{1,3})\}$

$D: \{(E_{1,2})\}$

$E: \{(A_{1,2}), (B_{1,1})\}$

Dijkstra - D $\begin{matrix} A & B & C & D & E \\ * & * & * & * & * \end{matrix}$

$Q: \{\underline{(E_{1,2})}\} \quad D-E \rightarrow 2$

$Q: \{(A_{1,2}), (\underline{B_{1,1}})\} \quad D-E-B \rightarrow 2$

$Q: \{\underline{(A_{1,4})}\} \quad D-E-A \rightarrow 4$

$Q: \{(C_{1,1+4})\} \quad D-E-A-C \rightarrow 5$

KUSKRAL

$A-C$	$B-E$	$D-E$	$E-A$	$B-C$	$C-D$	$A-B$	$D-B$
1	1	2	2	2	3	4	5

$$A-C \rightarrow 1$$

$$B-E \rightarrow 1$$

$$D-E \rightarrow 2$$

$$A-E \rightarrow 2$$

$$CT = 6$$

$$A : \{(B, 4), (C, 1)\}$$

$$B : \{(D, 5)\}$$

$$C : \{(B, 2), (D, 3)\}$$

$$D : \{(E, 2)\}$$

$$E : \{(A, 2), (B, 1)\}$$

Dijkstra - A $\begin{matrix} A & * & B & * & C & * & D & E \end{matrix}$

$$Q : \{(B, 4), (C, 1)\} \quad A-C \rightarrow 1$$

$$Q : \{(B, 2+1), (D, 3+1)\} \quad A-C-B \rightarrow 3$$

$$Q : \{(D, 4)\} \quad A-C-D \rightarrow 4$$

$$Q : \{(E, 2+4)\} \quad A-C-D-E \rightarrow 6$$

Dijkstra - B $\begin{matrix} A & * & B & * & C & * & D & E \end{matrix}$

$$Q : \{(D, 5)\} \quad B-D \rightarrow 5$$

$$Q : \{(E, 2+5)\} \quad B-D-E \rightarrow 7$$

$$Q : \{(A, 7+2)\} \quad B-D-E-A \rightarrow 9$$

$Q: \{ (C, 1+9) \} \quad B - D - E - A - C \rightarrow 10$

Dijkstra - C A B C D E
 * * * *

$Q: \{ (B, 2), (D, 3) \} \quad C - B \rightarrow 2$

$Q: \{ (D, 3) \} \quad C - D \rightarrow 3$

$Q: \{ (E, 2+3) \} \quad C - D - E \rightarrow 5$

$Q: \{ (A, 2+5) \} \quad C - D - E - A \rightarrow 7$

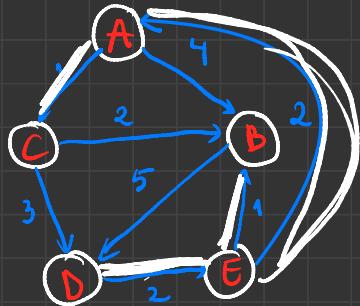
Dijkstra - E A B C D E
 * * * *

$Q: \{ (A, 2), (B, 1) \} \quad E - B \rightarrow 1$

$Q: \{ (A, 2), (D, 5+1) \} \quad E - A \rightarrow 2$

$Q: \{ (C, 1+2), (D, 5+1) \} \quad E - A - C \rightarrow 3$

$Q: \{ (D, 3+3) \} \quad E - A - C - D \rightarrow 6$



Dijkstra - B

A * B * C * D *

$$A : \{(B, 4), (C, 1)\}$$

$$B : \{(D, 5)\}$$

$$C : \{(B, 2), (D, 3)\}$$

$$D : \{(E, 2)\}$$

$$E : \{(A, 2), (B, 1)\}$$

$$Q : \{(D, 5)\} \quad B - D \rightarrow 5$$

$$Q : \{(E, 2+5)\} \quad B - D - E \rightarrow 7$$

$$Q : \{(A, 2+7)\} \quad B - D - E - A \rightarrow 9$$

$$Q : \{(C, 1+9)\} \quad B - D - E - A - C \rightarrow 10$$

START D

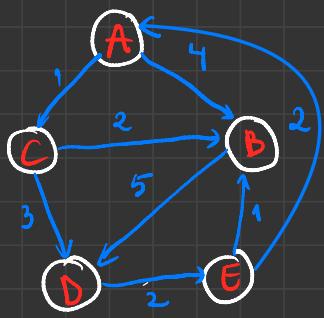
A * B * C * D * E ↑

$$Q : \{(E, 2)\} \quad D - E \rightarrow 2$$

$$Q : \{(A, 2+2), (B, 1+2)\} \quad D - E - B \rightarrow 3$$

$$Q : \{(A, 4), (D, 5+3)\} \quad D - E - A \rightarrow 4$$

$$Q : \{(C, 1+4)\} \quad D - E - A - C \rightarrow 5$$



Lista

A: $\{(B, 4), (C, 1)\}$

B: $\{(D, 5)\}$

C: $\{(B, 2), (D, 3)\}$

D: $\{(E, 2)\}$

E: $\{(A, 2), (B, 1)\}$

	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	2	∞	∞	0	2
E	2	1	∞	∞	0

DFT C

$$\begin{matrix} A & B & C & D & E \\ *_4 & *_1 & * & *_2 & *_3 \end{matrix}$$

C - B - D - E - A

BFT C

$$\begin{matrix} A & B & C & D & E \\ 3 & 1 & 0 & 1 & 2 \end{matrix}$$

C \leftarrow B
D - E - A

DJIKSTRA C

$$\begin{matrix} A & B & C & D & E \\ * & * & * & * & * \end{matrix}$$

C: Q: $\{(B, 2), (D, 3)\}$ C - B \rightarrow 2

B: Q: $\{(D, 3)\}$ C - D \rightarrow 3

D: Q: $\{(E, 2+3)\}$ C - D - E \rightarrow 5

$$E: Q: \{(A, 2+5)\} \quad C - D - E - A \Rightarrow 7$$

Dijkstra E A * B * C * D * E

E: Q: $\{(A, 2), (\underline{B}, 1)\}$ E-B $\rightarrow 1$

B: Q: $\{(A, 2), (D, 5+1)\}$ E-A $\rightarrow 2$

A: Q: $\{(C, 1+2), (D, 6)\}$ E-A-C $\rightarrow 3$

C: Q: $\{(D, 6+5)\}$ E-A-C-D $\rightarrow 8$
sum

E - B - D $\rightarrow 6$

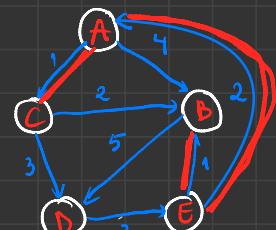
start E A * B * C * D * E

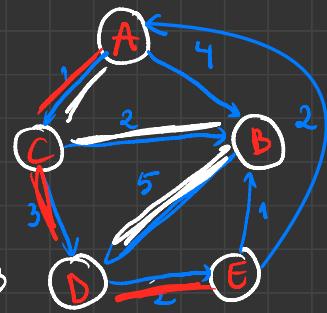
E: Q: $\{(A, 2), (\underline{B}, 1)\}$ E-B $\rightarrow 1$

B: Q: $\{(D, 5+1), (A, 2)\}$ E-A $\rightarrow 2$

A: Q: $\{(C, 1+2), (D, 6)\}$ E-A-C $\rightarrow 3$

C: Q: $\{(D, 6)\}$ E-A-C-D $\rightarrow 8$





Start A

A * B * C * D E

Q: $\{(B, 1)\}, \underline{(C, 1)}\}$ A-C $\rightarrow 1$

Q: $\{(B, 2+1)\}, \underline{(D, 3+1)}\}$ A-C-B $\rightarrow 3$

B Q: $\{(D, 4)\}$ A-C-D $\rightarrow 4$

Q: $\{(E, 2+4)\}$ A-C-D-E $\rightarrow 5$

Start B

A B C D E
* * * *

Q: $\{(D, 5)\}$ B-D $\rightarrow 5$

Q: $\{(E, 2+5)\}$ B-D-E $\rightarrow 7$

Q: $\{(A, 2+7)\}$ B-D-E-A $\rightarrow 9$

Q: $\{(C, 1+1)\}$ B-D-E-A-C $\rightarrow 10$

Liste

A: $\{(B, 4), (C, 1)\}$

B: $\{(D, 5)\}$

C: $\{(B, 2), (D, 3)\}$

D: $\{(E, 2)\}$

E: $\{(A, 2), (B, 1)\}$

Start D

A * B * C * D E
* * * *

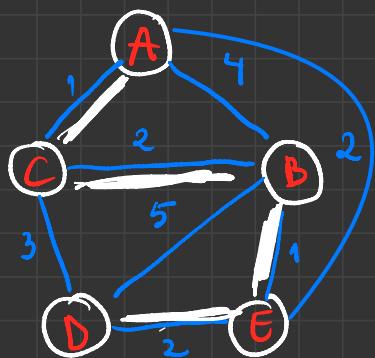
Q: $\{(E, 2)\}$ D-E $\rightarrow 2$

Q: $\{(A, 2+2), \underline{(B, 1+2)}\}$ D-E-B $\rightarrow 3$

$$Q: \{ (\underline{A}, 4) \}$$

$$D - E - A \rightarrow 4$$

$$Q: \{ (C, 1 + 4) \} \quad D - E - A - C \rightarrow 5$$



$$A: \{ (B, 4), (C, 1), (E, 2) \}$$

$$B: \{ (A, 4), (C, 2), (D, 5), (E, 1) \}$$

$$C: \{ (A, 1), (B, 2), (D, 3) \}$$

$$D: \{ (B, 5), (C, 3), (E, 2) \}$$

$$E: \{ (A, 2), (B, 1), (D, 2) \}$$

PRIM C A B C D E

$$Q: \{ (\underline{A}, 1), (B, 2), (D, 3) \} \quad C - A \rightarrow 1$$

$$Q: \{ (\underline{B}, 2), (D, 3), (E, 1) \} \quad C - B \rightarrow 2$$

$$Q: \{ (D, 3), (\underline{E}, 1) \} \quad B - E \rightarrow 1$$

$$Q: \{ (D, 2) \}$$

$$\frac{E - D \rightarrow 2}{CT = 6}$$

PRIM D

A B C D E

$$Q: \{(B, 5), (C, 3), (\underline{E}, 2)\} \quad D - E \rightarrow 2$$

$$Q: \{(A, 2), (\underline{B}, 1), (C, 3)\} \quad E - B \rightarrow 1$$

$$Q: \{\underline{(A, 2)}, (C, 2)\} \quad B - \# \rightarrow 2$$

$$Q: \{(C, 1)\}$$

$$\overline{A - C \rightarrow 1}$$

$$C^T = 6$$

$\bar{E}A - AC$

	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	2	∞	∞	0	2
E	2	1	∞	∞	0

A	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	2	∞	∞	0	2
E	2	1	3	∞	0

$AB - BD$

B	A	B	C	D	E
A	0	4	1	9	∞
B	∞	0	∞	5	∞
C	∞	2	0	7	∞
D	∞	∞	∞	0	2
E	2	1	3	3	0

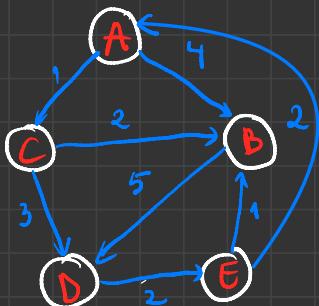
PRIM D A B C D E

D: Q: $\{(A|B), (\underline{C|1}), (E|2)\}$ D-C-1

C: Q: $\{(A|2), (\underline{B|2})\}$ C-A-2

A: Q: $\{(\underline{B|1}), (E|1)\}$ A-B-1

A: $\{(\underline{E|})\}$ B-E-1



	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	∞	∞	∞	0	2
E	2	1	∞	∞	0

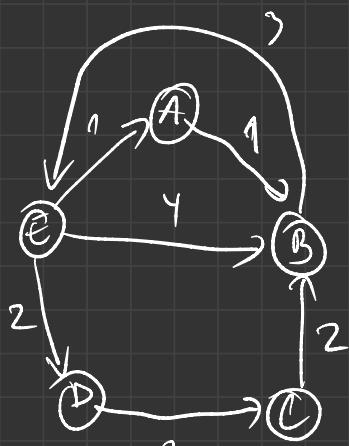
	A	B	C	D	E
A	0	4	1	∞	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	∞	∞	∞	0	2
E	2	1	∞	∞	0

	A	B	C	D	E
A	0	4	1	9	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	∞	∞	∞	0	2
E	2	1	3	6	0

	A	B	C	D	E
A	0	3	1	4	∞
B	∞	0	∞	5	∞
C	∞	2	0	3	∞
D	∞	5	∞	0	2
E	2	1	3	6	0

	A	B	C	D	E
A	0	3	1	4	6
B	∞	0	∞	5	7
C	∞	2	0	3	5
D	∞	∞	∞	0	2
E	2	1	3	6	0

	A	B	C	D	E
A	0	3	1	4	6
B	9	0	10	7	
C	7	2	0	3	5
D	4	3	5	0	2
E	2	1	3	6	0



$$A: \{(B, 1)\}$$

$$B: \{(E, 3)\}$$

$$C: \{(B, 2)\}$$

$$D: \{(C, 3)\}$$

$$E: \{(A, 1), (B, 4), (D, 2)\}$$

DiJKSTRA D

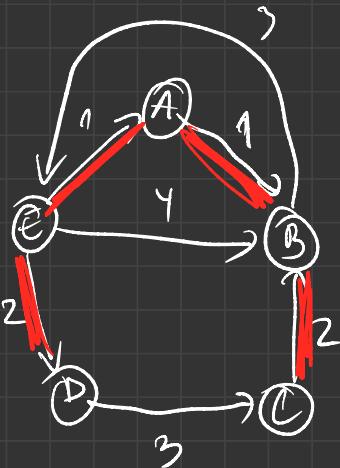
A B C D E
A → *

D → C → 3

Q: $\{B | 2+3\}$ D → C → B → T

Or: $\{E | 3+T\}$ D → C → B → T → J

Q: $\{A | 3+8\}$ D → C → B → E → A = 9



- $A : \{(B, 1), (E, 1)\}$
 $B : \{(A, 1), (C, 2), (E, 3)\}$
 $C : \{(B, 2), (D, 3)\}$
 $D : \{(C, 3), (E, 2)\}$
 $E : \{(A, 1), (B, 3)\}$

PRIM D $\begin{matrix} A & B \\ \cancel{A} & \cancel{B} \end{matrix} \leftarrow \begin{matrix} D & C \\ \cancel{D} & \cancel{C} \end{matrix}$
 $\alpha : \{(C, 3), (E, 2)\}$ $D - E \rightarrow 2$
 $\alpha : \{(A, 1), (B, 2)\}$ $E - A \rightarrow 1$
 $\alpha : \{(B, 1)\}$ $A - B \rightarrow 1$
 $\alpha : \{(C, 2)\}$ $B - C \rightarrow 2$

$CT = 6$

$A - B$	$A - E$	$B - C$	$D - E$	$D - C$	$B - E$
1	1	2	2	3	3

$A - B \rightarrow 1$ $A - E \rightarrow 1$ $B - C \rightarrow 2$ $D - E \rightarrow 2$

$CT = 6$

A: $\{(B_{1,1})\}$

B: $\{(E, 3)\}$

C: $\{(B_{1,2})\}$

D: $\{(C, 3)\}$

E: $\{(A, 1), (B, 4), (D, 2)\}$

PROGRAM E A B C D E

Q: $\{(A, 1), (B, 5), (D, 2)\}$ E-A \rightarrow 1

Q: $\{(B, 1+1), (D, 2)\}$ E-A-B \rightarrow 2

Q: $\{(D, 2)\}$ E-D \rightarrow 2

Q: $\{(C, 3+2)\}$ E-D-C \rightarrow 5

det drum de cat minim dintr-un pt x in totu

EXAMEN

SORTÄRi

BUBBLE SORT

18, 3, 29, 11, 45, 27, 34, 8, 25, 37, 15

$i=0, j=0, 18 > 3, T \Rightarrow \text{swap}(18, 3)$

3 18 29 11 45 27 34 8 25 37 15

$i=0, j=1, 18 > 29 F$

$i=0, j=2, 29 > 11, T \Rightarrow \text{swap}(29, 11)$

3 18 11 29 45 27 34 8 25 37 15

$i=0, j=3, 29 > 45 "F"$
 $i=0, j=4, 45 > 27 "T" \Rightarrow \text{swap}(45, 27)$

3 18 11 29 27 45 34 8 25 37 15

$i=0, j=5, 45 > 34, "T" \Rightarrow \text{swap}(45, 34)$

3 18 11 29 27 34 45 8 25 37 15

$i=0, j=6, 45 > 8, "T" \Rightarrow \text{swap}(45, 8)$

3 18 11 29 27 34 8 45 25 37 15

$i=0, j=7, 45 > 25, "T" \Rightarrow \text{swap}(45, 25)$

3 18 11 29 27 34 8 25 45 37 15

$i=0, j=8, 45 > 37, "T"$

$$i=0, j=9 \quad b_5 > 15 \quad T^4$$

3 18 \rightsquigarrow 11 29 \rightsquigarrow 27 34 \rightsquigarrow 8 25 \rightsquigarrow 37 \rightsquigarrow 15 45

$$i=1, j=0 \dots 8$$

3 11 18 27 \rightsquigarrow 29 \rightsquigarrow 8 25 \rightsquigarrow 34 \rightsquigarrow 15 37 45

$$i=2, j=0 \dots 7$$

3 11 18 27 \rightsquigarrow 8 \rightsquigarrow 25 \rightsquigarrow 29 \rightsquigarrow 15 34 37 45

$$i=3, j=0 \dots 6$$

3 11 \rightsquigarrow 18 \rightsquigarrow 8 25 \rightsquigarrow 27 \rightsquigarrow 15 29 34 37 45

$$i=4, j=0 \dots 5$$

3 11 \rightsquigarrow 8 18 \rightsquigarrow 25 \rightsquigarrow 15 27 29 34 37 45

$$i=5, j=0 \dots 4$$

3 8 11 \rightsquigarrow 18 \rightsquigarrow 15 25 27 29 34 37 45

$$i=6, j=0, 3$$

3 8 11 15 18 25 27 29 34 37 45

7 3 10 26 18 15 9

i=0 j=0

3 7 10 26 18 15 9

i=0 j=1 F
j=2 F
j=3

3 7 10 18 26 15 9

i=0 j=4

3 7 10 18 15 26 9

i=0 j=5

3 7 10 18 15 9 26

i=1 j=0, 4

3 7 10 15 9 18 26

i=2 j=0, 3

3 7 10 9 15 18 26

i=3 j=0, 2

3 7 9 10 15 18 26

7 3 10 29 18 15 9

i=0

min=7

3 7 10 29 18 15 9

i=1

min=7

3 7 10 29 18 15 9

i=2

min=10

3 7 9 29 18 15 10

i=3

min=29

3 7 9 10 18 15 29

j=4

min=10

3 7 9 10 15 18 29

INSERTION SORT

7 3 10 29 18 15 9
 |

3 7 10 29 18 15 9

3 7 10 29 18 15 9

3 7 10 29 18 15 9
 |

3 7 10 18 29 15 3

1

3 7 10 15 18 29 9

1

3 7 9 10 15 18 29

23 8 12 4 22 7

1

8 23 12 4 22 7 ✓

1

8 12 23 4 22 7 ✓

1

4 8 12 23 22 7 ✓

1

4 8 12 22 23 7 ✓

1

4 7 8 12 22 23 ✓

18, 3, 29, 11, 45, 27 | 34, 8, 25, 37, 15

[18, 3, 29 | 11, 45, 27] [34, 8, 25 | 37, 15]

[18, 3 | 29] [11, 45 | 27] [34, 8 | 25] [37 | 15]

[10 | 3] [29] [11 | 45] [27] [34 | 8] [25] [37] [15]

[18] [3] [29] [11] [45] [27] [34] [8] [25] [37] [15]

[3, 18] [11, 45] [8, 34]

[3, 18, 29] [11, 27, 45] [8, 25, 34] [15, 37]

[3, 11, 18, 27, 29, 45] [8, 15, 25, 34, 37]

[3, 8, 11, 15, 18, 25, 27, 29, 34, 37, 45]

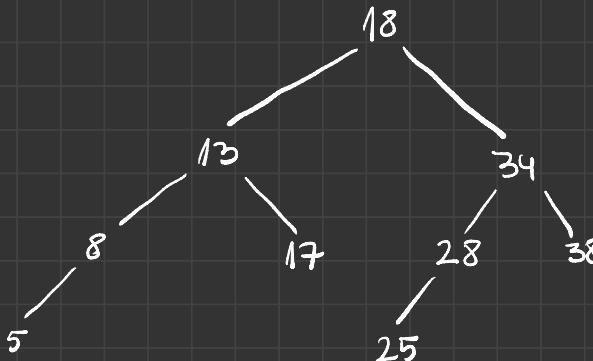
Bubble Sort : Avg time $O(n^2)$, Space $O(1)$
Selection Sort : Avg time $O(n^2)$, Space $O(1)$
Insertion Sort : Avg time $O(n^2)$, Space $O(n)$

Merge Sort : Avg time $O(n \log n)$, Space $O(n)$
Quick Sort : Avg time $O(n \log n)$, Space $O(n \log n)$

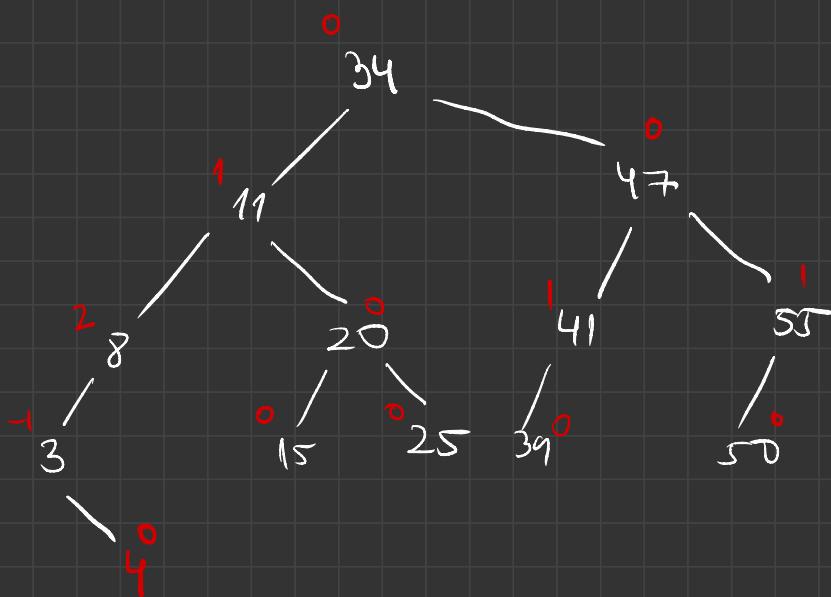
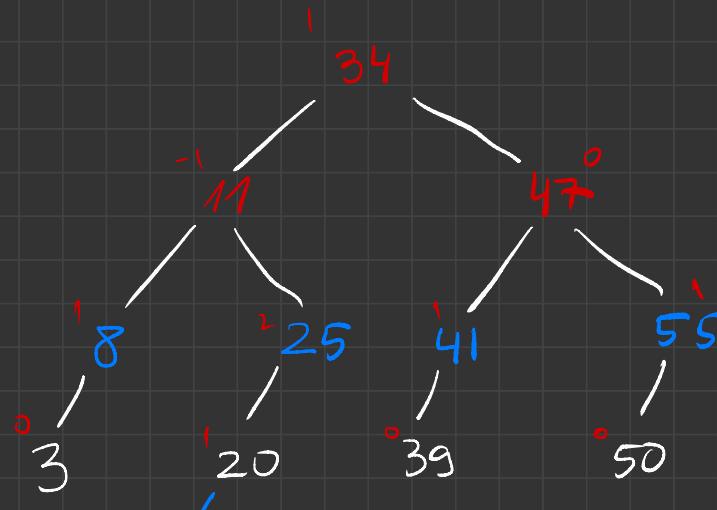
Bucket Sort : Avg time $O(n+k)$, Space $O(n+k)$, k - nr of buckets
Radix Sort : Avg time $O(nk)$, Space $O(nk)$, d - nr of digits

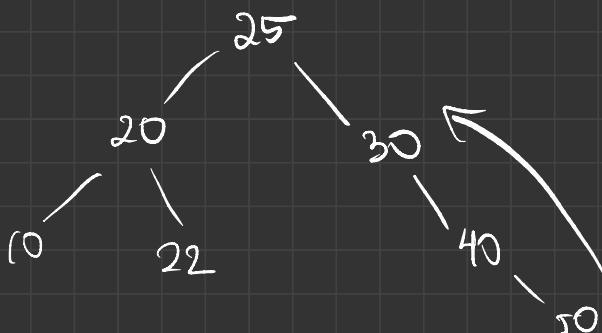
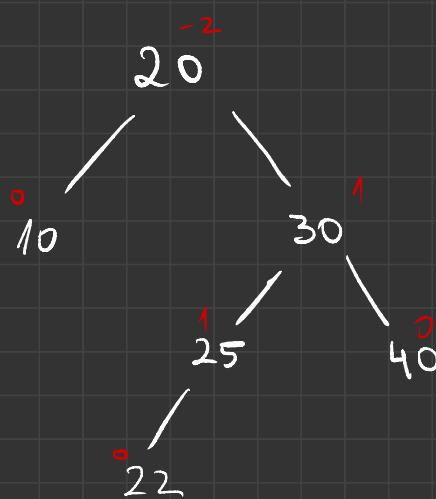
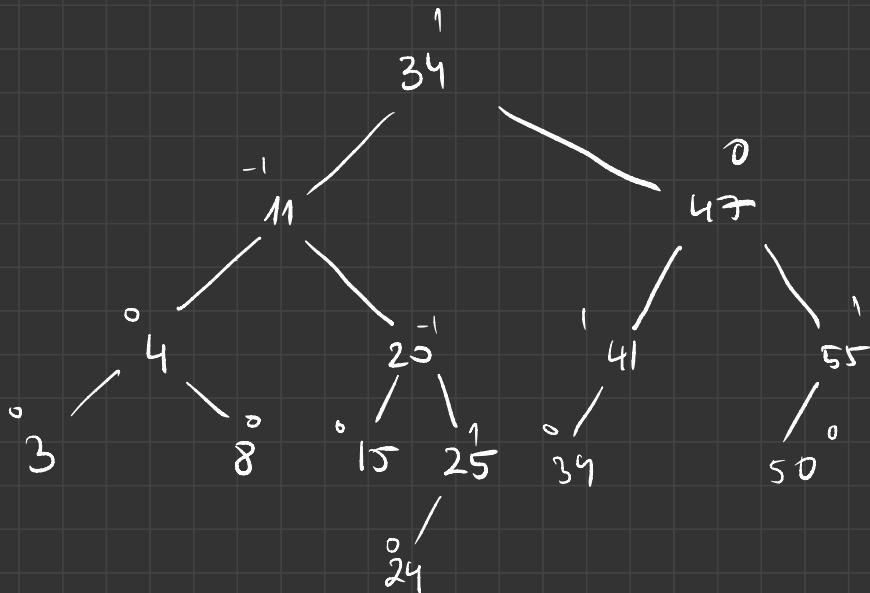
ARBORI

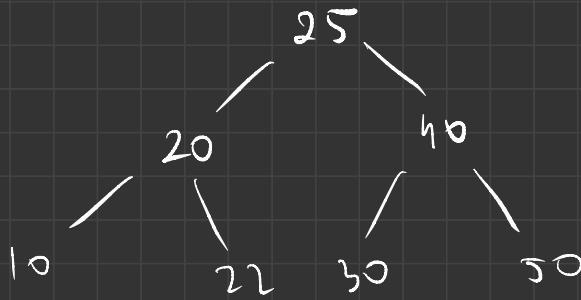
5 8 13 17 18 25 28 34 38



3 8 11 20 25 34 39 41 47 50 55



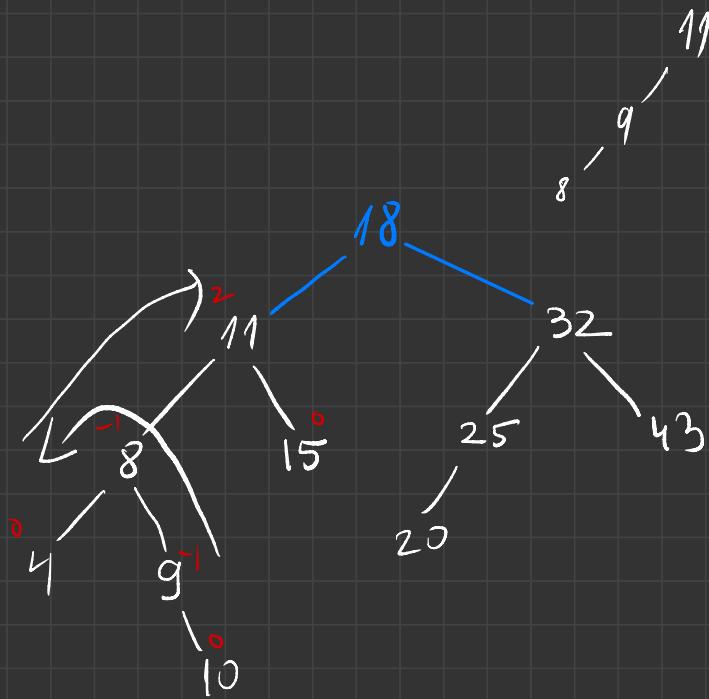




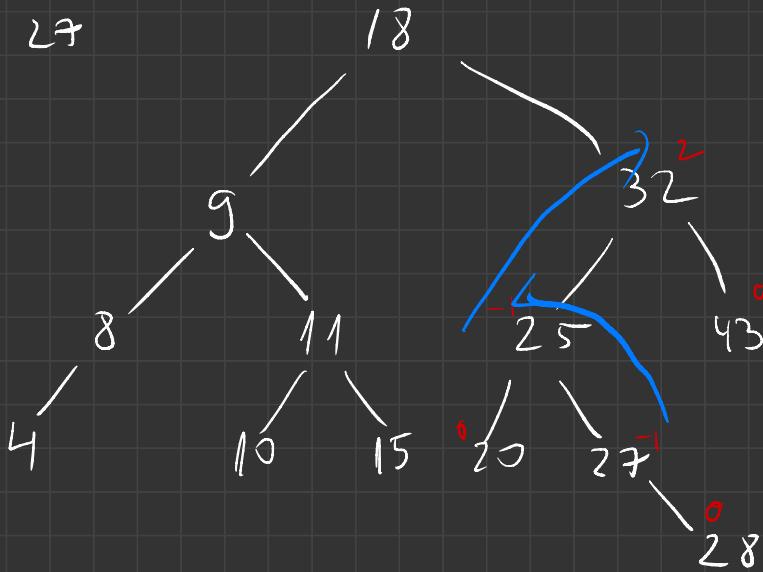
4 8 11 15 18 20 25 32 43

insert 9

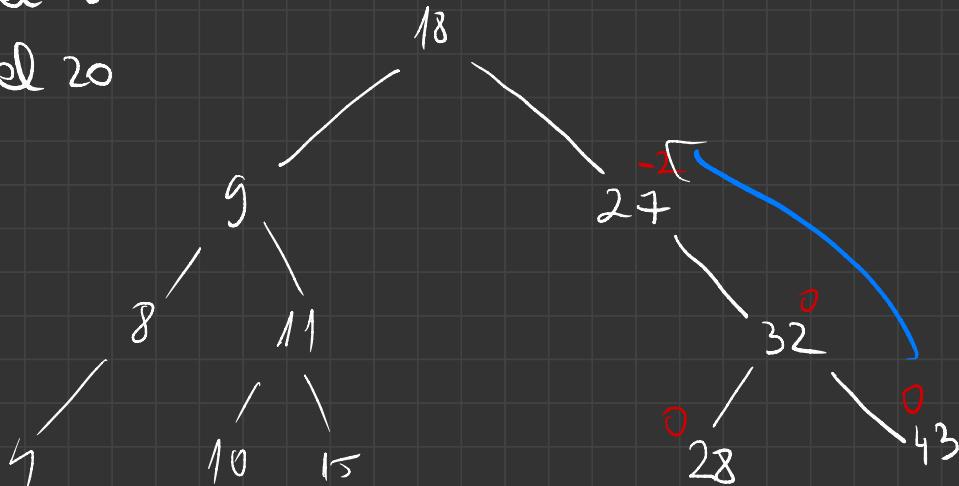
insert 10



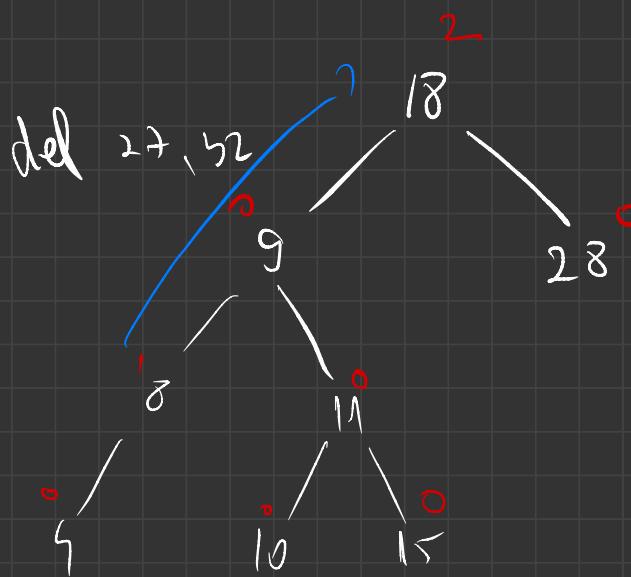
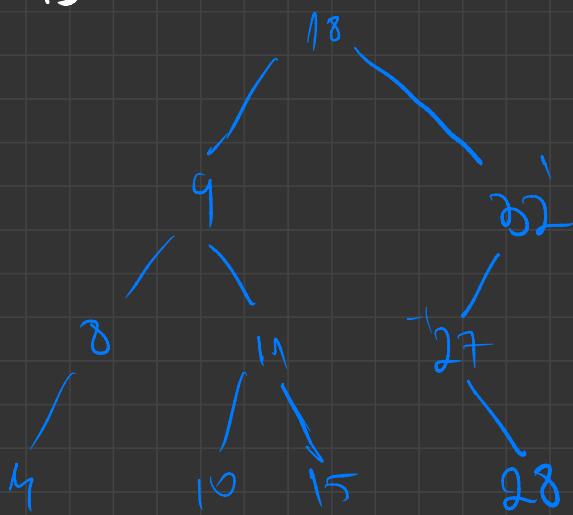
\(\rightarrow\) 27

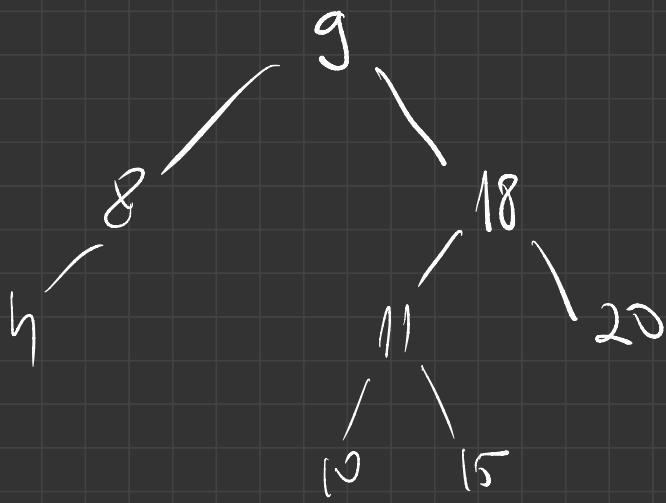


del 25
del 20

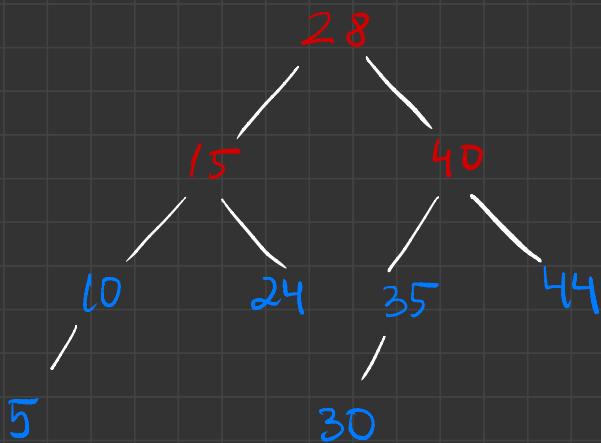


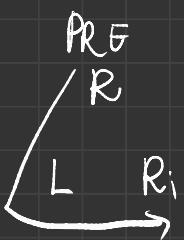
del 43



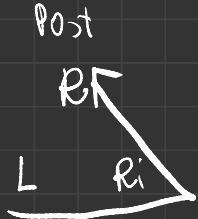


5 10 15 24 28 30 35 40 44



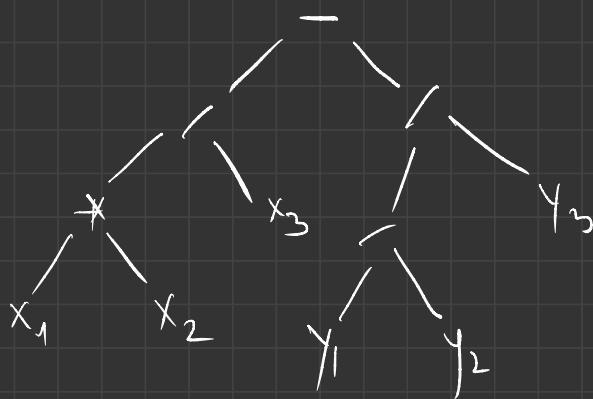
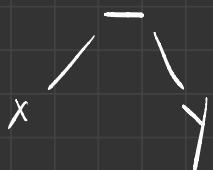


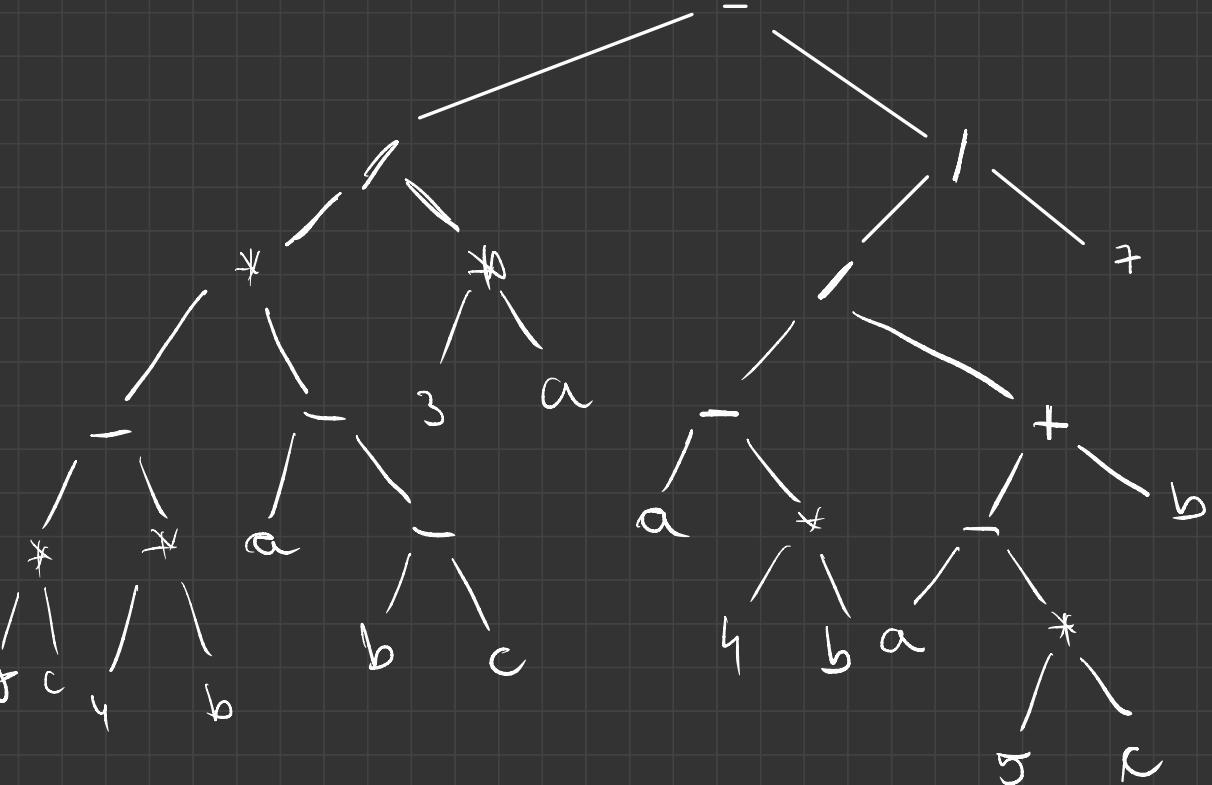
$R L R_i$



$L R_i R$

$$\frac{(5^*a - 4^*b)^*(a-b-c) / 3^*a - (a-4^*b)/(a-5^*c+b)/7}{x_1 \textcolor{red}{x} x_2 \textcolor{blue}{x}_3 \textcolor{red}{y} \textcolor{blue}{y}_2 \textcolor{blue}{y}_3}$$





$$\frac{5^* \alpha - 4^* b}{x} * (a - b - c) / 3^* \alpha - (a - 4^* b) / (a - 5^* c + b) / 7$$

x_1

x

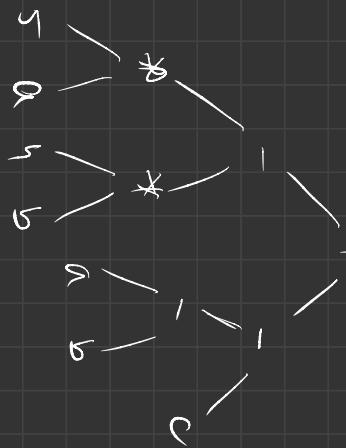
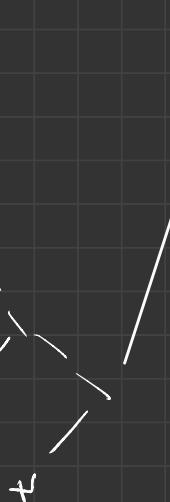
x_2

x_3

y_1

y_2

y_3



PRE ORDER: RLRLR - * / * - * 5 a * 4 b - - a b c 3 a / / - a *

$4b + - \alpha * 5c 3 \beta$

POST ORDER: LRRLR 5 a * 4 b * - a b - c - * 3 / a * a 4 b * - a 5 c *

$- \beta + / \beta / -$

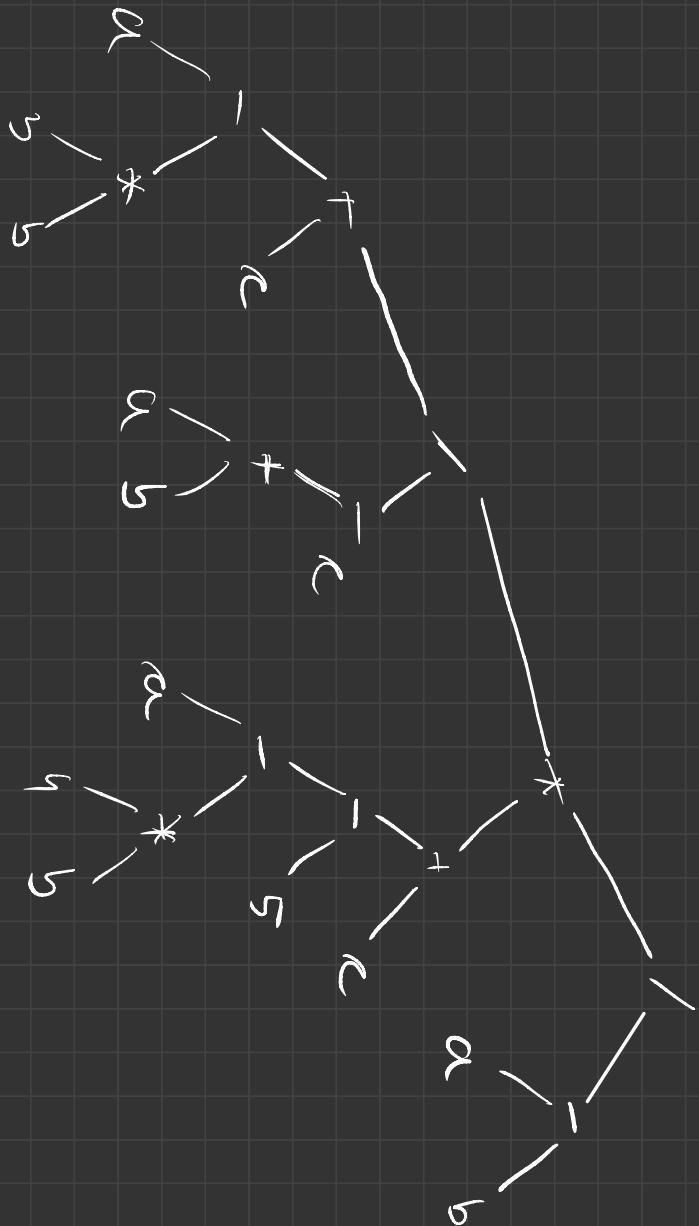
$$(a - 3^* b + c) / (a + b - c)^* (a - 4^* b - 5 + c) / (a - b)$$

x_1

x_2

x_3

y

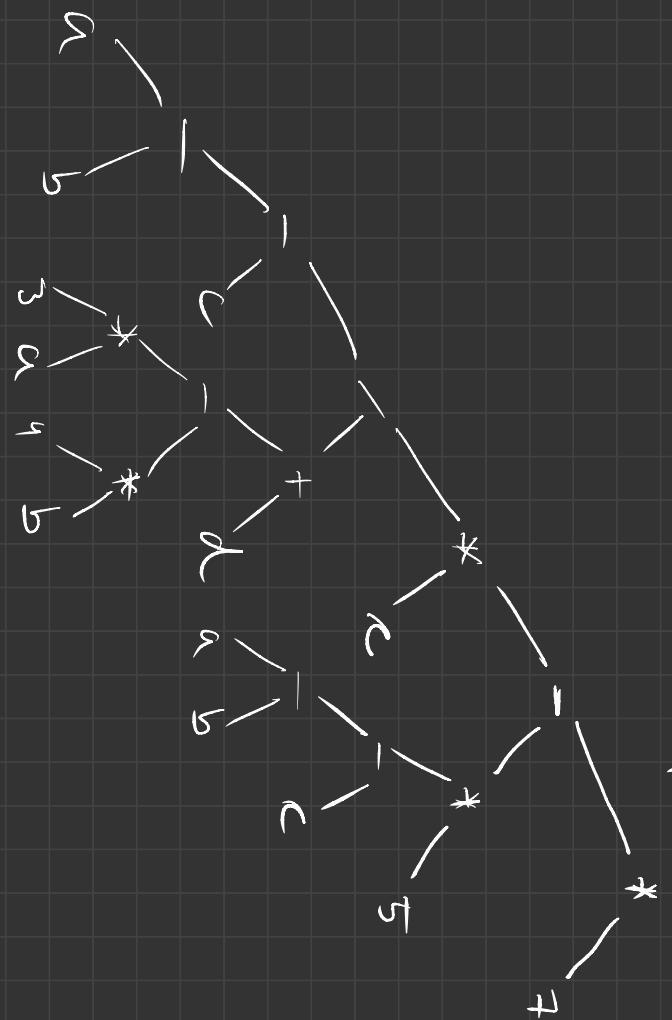


PREORDER: RL_i : / * / + - a * 3 b c - + a b c t - - a

* 4 b 5 c - a b

POSTORDER: LR_iR : a 3 b * - c + a b t + c - / a 4 b * - b - c + * a

$$\overbrace{(a-b-c) / (3*a - 4*b + d)}^{x_1} * \overbrace{\pi - (a-b-c)*5}{x_2} * \overbrace{7}{x_3}$$



PREORDER : RLRL : * - * / - - ab c + - * 3 a * 4 b d c

* - - a b c 5 7

POSTORDER : LRRL : a b - c - 3 a * 4 b * - d + / c * 9 -

c - 5 * - 7 *