

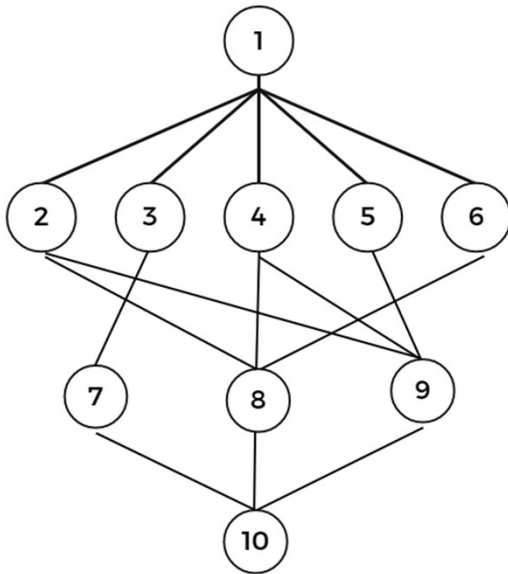
# **EECE7205\_Project2**

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# Input Examples 1

Task Graph



The directed graph was created using XMind. Since arrows cannot be used, the top-to-bottom connection means the top-to-bottom direction.

Execution Time Table

Task	Core1	Core2	Core3
1	9	7	5
2	8	6	5
3	6	5	4
4	7	5	3
5	5	4	2
6	7	6	4
7	8	5	3
8	6	4	2
9	5	3	2
10	7	4	2

*Cloud scheduling time:*

$$T_{send} = 3$$

$$T_{cloud} = 1$$

$$T_{receive} = 1$$

The power consumption of the kth core:

$$P_1 = 1$$

$$P_2 = 2$$

$$P_3 = 4$$

$$P_{RF} = 0.5$$

# Initial Scheduling Result – Examples 1

Program Output

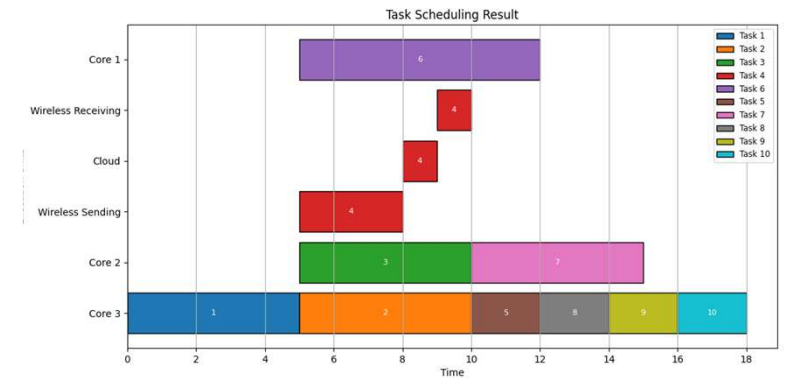
```
=== Task Scheduling Table ===
```

Task	Start Time	Finish Time	Location	Core
1	0	5	Core	3
2	5	10	Core	3
3	5	10	Core	2
4	5	10	Cloud	-
6	5	12	Core	1
5	10	12	Core	3
7	10	15	Core	2
8	12	14	Core	3
9	14	16	Core	3
10	16	18	Core	3

## The reason why it is different from the paper:

In the initial scheduling, since there is no limit on energy consumption, as long as they do not conflict with each other and complete the priority order constraints, there are many ways to generate the scheduling graph.

Initial scheduling result



$$T = 18$$

Energy consumption calculation:

$$E_1 = 1 \times 7 = 7$$

$$E_2 = 2 \times 5 + 2 \times 5 = 20$$

$$E_3 = 4 \times 5 + 4 \times 5 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 = 72$$

$$E_{Cloud} = 0.5 \times 3 = 1.5$$

$$E_{TOTAL} = 7 + 20 + 72 + 2 = 100.5$$

```
=== Energy Consumption ===
Core 1 Energy: 7
Core 2 Energy: 20
Core 3 Energy: 72
Cloud Energy: 2.0
Total Energy: 101.0
```

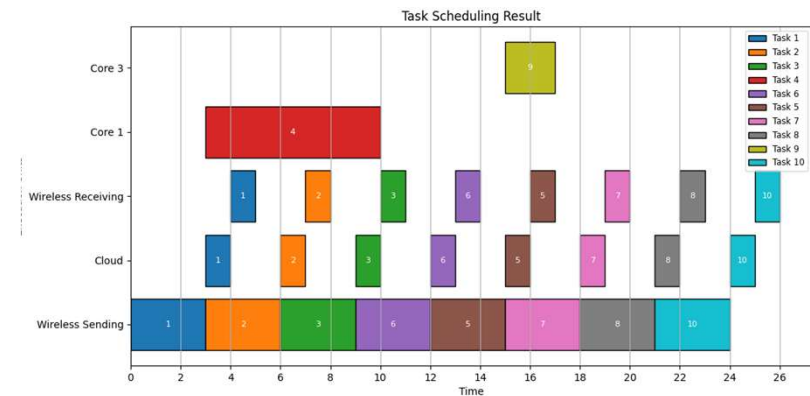
# Final Scheduling Result – Examples 1

Program Output

Initial scheduling result

```

=== Task Scheduling Table ===
Task  Start Time  Finish Time  Location  Core
1      0          5        Cloud    -
2      3          8        Cloud    -
3      6          11       Cloud    -
4      3          10       Core     1
6      9          14       Cloud    -
5     12          17       Cloud    -
7     15          20       Cloud    -
8     18          23       Cloud    -
9     15          17       Core     3
10    21          26       Cloud    -
    
```



$$T_{max} = 27$$

Energy consumption calculation:

$$E_1 = 1 \times 7 = 7$$

$$E_3 = 4 \times 2 = 8$$

$$E_{Cloud} = 0.5 \times 3 \times 8 = 12$$

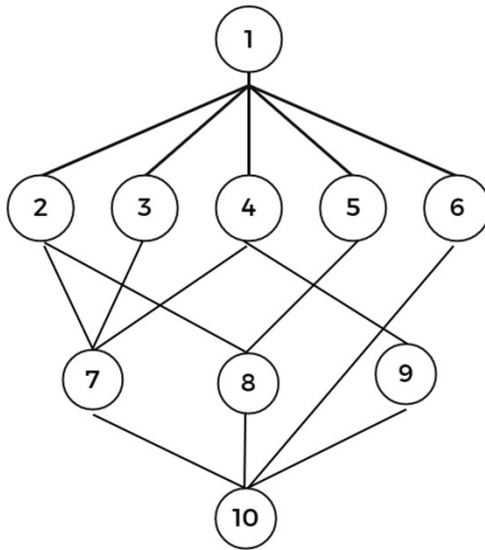
$$E_{TOTAL} = 7 + 8 + 12 = 27$$

## Summary of T and E after optimize

$T_{Total}^{Initial}$	$T_{Total}^{Final}$	$E_{Total}^{Initial}$	$E_{Total}^{Final}$
18	26	101	27

# Input Examples 2

Task Graph



The directed graph was created using XMind. Since arrows cannot be used, the top-to-bottom connection means the top-to-bottom direction.

Execution Time Table

Task	Core1	Core2	Core3
1	9	7	5
2	8	6	5
3	6	5	4
4	7	5	3
5	5	4	2
6	7	6	4
7	8	5	3
8	6	4	2
9	5	3	2
10	7	4	2

*Cloud scheduling time:*

$$T_{send} = 3$$

$$T_{cloud} = 1$$

$$T_{receive} = 1$$

The power consumption of the kth core:

$$P_1 = 1$$

$$P_2 = 2$$

$$P_3 = 4$$

$$P_{RF} = 0.5$$

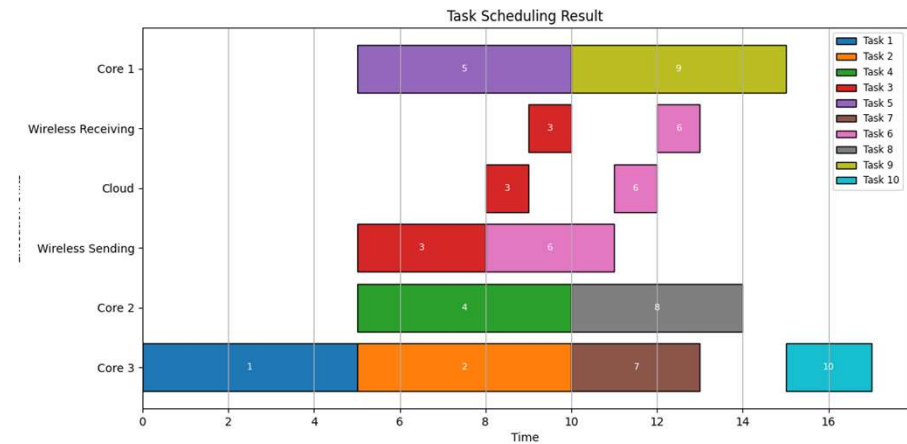
# Initial Scheduling Result – Examples 2

Program Output

```

=== Task Scheduling Table ===
Task  Start Time  Finish Time  Location  Core
1      0           5           Core      3
2      5           10          Core      3
4      5           10          Core      2
3      5           10          Cloud     -
5      5           10          Core      1
7      10          13          Core      3
6      8           13          Cloud     -
8      10          14          Core      2
9      10          15          Core      1
10     15          17          Core      3
    
```

Initial scheduling result



$$T = 17$$

Energy consumption calculation:

$$E_1 = 1 \times 5 + 1 \times 5 = 10$$

$$E_2 = 2 \times 5 + 2 \times 4 = 18$$

$$E_3 = 4 \times 5 + 4 \times 5 + 4 \times 3 + 4 \times 2 = 60$$

$$E_{cloud} = 0.5 \times 3 \times 2 = 3$$

$$E_{TOTAL} = 10 + 18 + 60 + 3 = 91$$

```

=== Energy Consumption ===
Core 1 Energy: 10
Core 2 Energy: 18
Core 3 Energy: 60
Cloud Energy: 3.0
Total Energy: 91.0
    
```

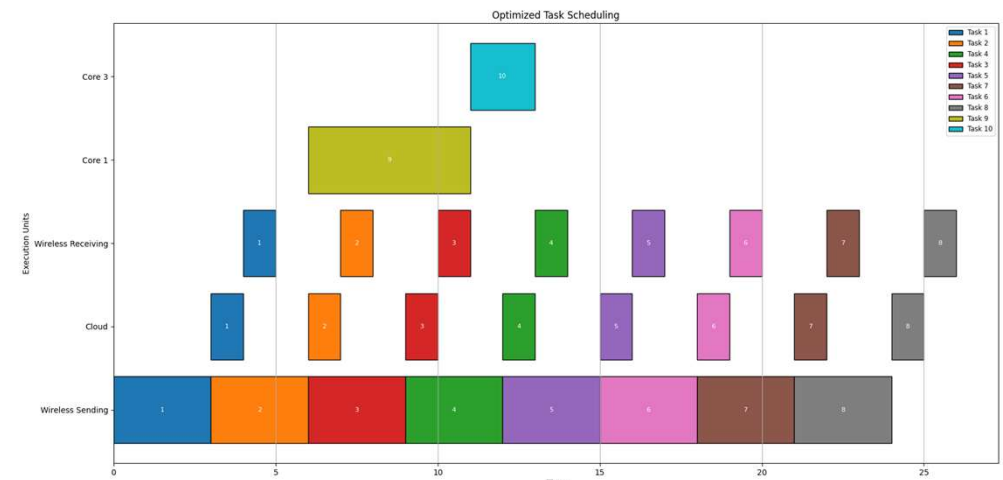
# Final Scheduling Result – Examples 2

Program Output

=== Task Scheduling Table ===

Task	Start Time	Finish Time	Location	Core
1	0	5	Cloud	-
2	3	8	Cloud	-
4	9	14	Cloud	-
3	6	11	Cloud	-
5	12	17	Cloud	-
7	18	23	Cloud	-
6	15	20	Cloud	-
8	21	26	Cloud	-
9	6	11	Core	1
10	11	13	Core	3

Initial scheduling result



$$T_{max} = 26$$

Energy consumption calculation:

$$E_1 = 1 \times 5 = 5$$

$$E_3 = 4 \times 2 = 8$$

$$E_{Cloud} = 0.5 \times 3 \times 8 = 12$$

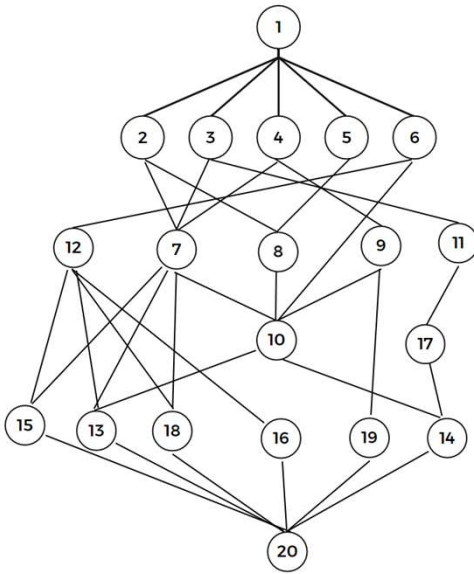
$$E_{TOTAL} = 5 + 8 + 12 = 25$$

Summary of T and E after optimize

$T_{Total}^{Initial}$	$T_{Total}^{Final}$	$E_{Total}^{Initial}$	$E_{Total}^{Final}$
17	26	91	25

# Input Examples 3

Task Graph



The directed graph was created using XMind. Since arrows cannot be used, the top-to-bottom connection means the top-to-bottom direction.

Execution Time Table

Task	Core1	Core2	Core3
1	9	7	5
2	8	6	5
3	6	5	4
4	7	5	3
5	5	4	2
6	7	6	4
7	8	5	3
8	6	4	2
9	5	3	2
10	7	4	2
11	8	3	2
12	5	3	2
13	6	5	4
14	4	4	3
15	6	6	5
16	6	6	5
17	4	3	2
18	4	3	2
19	5	4	2
20	8	4	2

*Cloud scheduling time:*

$$T_{send} = 3$$

$$T_{cloud} = 1$$

$$T_{receive} = 1$$

The power consumption of the kth core:

$$P_1 = 1$$

$$P_2 = 2$$

$$P_3 = 4$$

$$P_{RF} = 0.5$$



# Initial Scheduling Result – Examples 3

Program Output

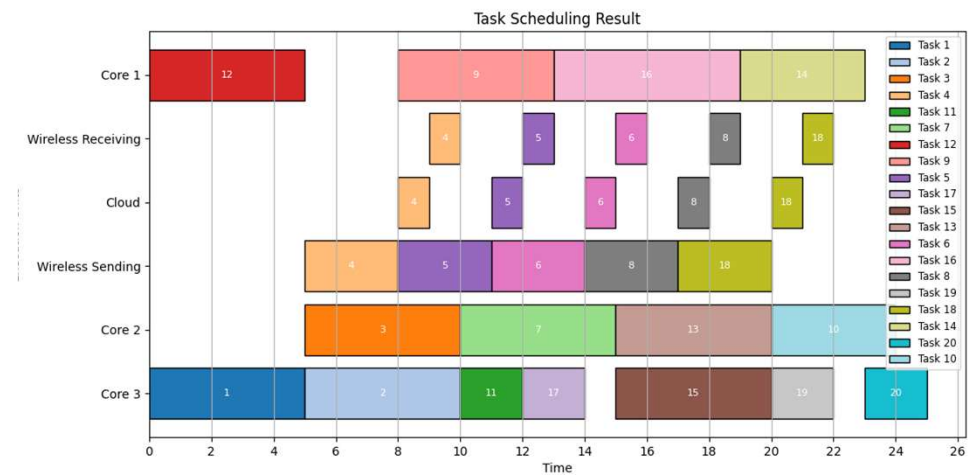
=== Task Scheduling Table ===				
Task	Start Time	Finish Time	Location	Core
1	0	5	Core	3
2	5	10	Core	3
3	5	10	Core	2
4	5	10	Cloud	-
11	10	12	Core	3
7	10	15	Core	2
12	0	5	Core	1
9	8	13	Core	1
5	8	13	Cloud	-
17	12	14	Core	3
15	15	20	Core	3
13	15	20	Core	2
6	11	16	Cloud	-
16	13	19	Core	1
8	14	19	Cloud	-
19	20	22	Core	3
18	17	22	Cloud	-
14	19	23	Core	1
20	23	25	Core	3
10	20	24	Core	2

```

=== Energy Consumption ===
Core 1 Energy: 20
Core 2 Energy: 38
Core 3 Energy: 92
Cloud Energy: 7.5
Total Energy: 157.5

```

Initial scheduling result



$$T = 25$$

Energy consumption calculation:

$$E_1 = 1 \times 5 + 1 \times 5 + 1 \times 6 + 1 \times 4 = 20$$

$$E_2 = 2 \times 5 + 2 \times 5 + 2 \times 5 + 2 \times 4 = 38$$

$$E_3 = 4 \times 5 + 4 \times 5 + 4 \times 2 + 4 \times 2 + 4 \times 5 + 4 \times 2 + 4 \times 2 = 92$$

$$E_{cloud} = 0.5 \times 3 \times 5 = 7.5$$

$$E_{TOTAL} = 20 + 38 + 92 + 7.5 = 157.5$$

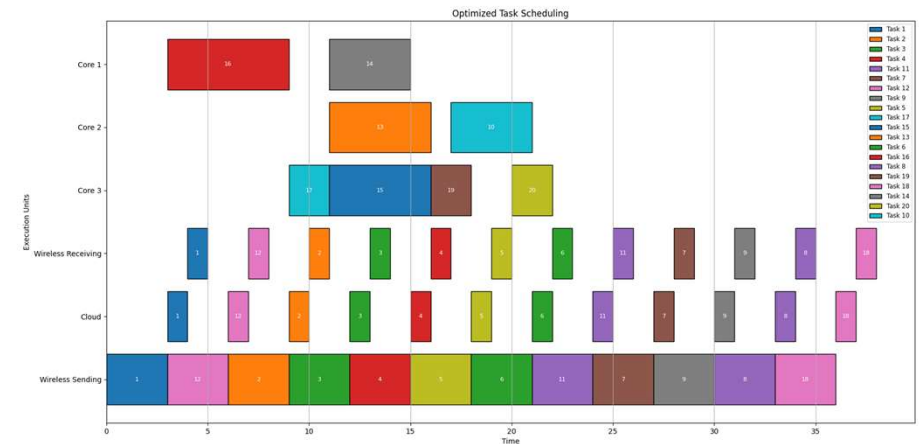
# Final Scheduling Result – Examples 3

Program Output

Initial scheduling result

=== Task Scheduling Table ===

Task	Start Time	Finish Time	Location	Core
1	0	5	Cloud	-
2	6	11	Cloud	-
3	9	14	Cloud	-
4	12	17	Cloud	-
11	21	26	Cloud	-
7	24	29	Cloud	-
12	3	8	Cloud	-
9	27	32	Cloud	-
5	15	20	Cloud	-
17	9	11	Core	3
15	11	16	Core	3
13	11	16	Core	2
6	18	23	Cloud	-
16	3	9	Core	1
8	30	35	Cloud	-
19	16	18	Core	3
18	33	38	Cloud	-
14	11	15	Core	1
20	20	22	Core	3
10	17	21	Core	2



$$T_{max} = 38$$

Energy consumption calculation:

$$E_1 = 1 \times 6 + 1 \times 4 = 20$$

$$E_2 = 2 \times 5 + 2 \times 4 = 18$$

$$E_3 = 4 \times 2 + 4 \times 5 + 4 \times 2 + 4 \times 2 = 44$$

$$E_{Cloud} = 0.5 \times 3 \times 12 = 18$$

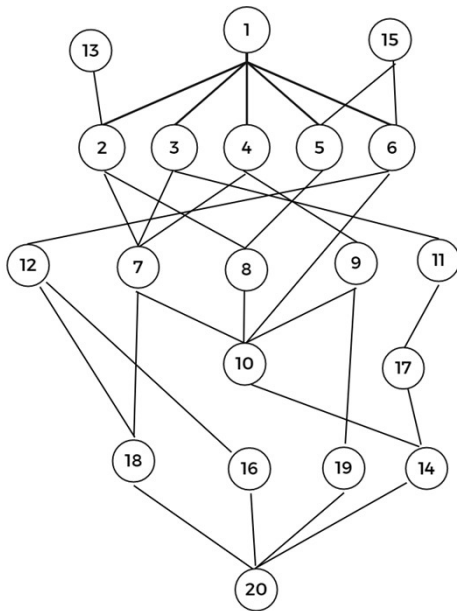
$$E_{TOTAL} = 20 + 18 + 44 + 18 = 100$$

Summary of T and E after optimize

$T_{Total}^{Initial}$	$T_{Total}^{Final}$	$E_{Total}^{Initial}$	$E_{Total}^{Final}$
25	38	157.5	100

# Input Examples 4

Task Graph



The directed graph was created using XMind. Since arrows cannot be used, the top-to-bottom connection means the top-to-bottom direction.

Execution Time Table

Task	Core1	Core2	Core3
1	9	7	5
2	8	6	5
3	6	5	4
4	7	5	3
5	5	4	2
6	7	6	4
7	8	5	3
8	6	4	2
9	5	3	2
10	7	4	2
11	8	3	2
12	5	3	2
13	6	5	4
14	4	4	3
15	6	6	5
16	6	6	5
17	4	3	2
18	4	3	2
19	5	4	2
20	8	4	2

*Cloud scheduling time:*

$$T_{send} = 3$$

$$T_{cloud} = 1$$

$$T_{receive} = 1$$

The power consumption of the kth core:

$$P_1 = 1$$

$$P_2 = 2$$

$$P_3 = 4$$

$$P_{RF} = 0.5$$

# Initial Scheduling Result – Examples 4

Program Output

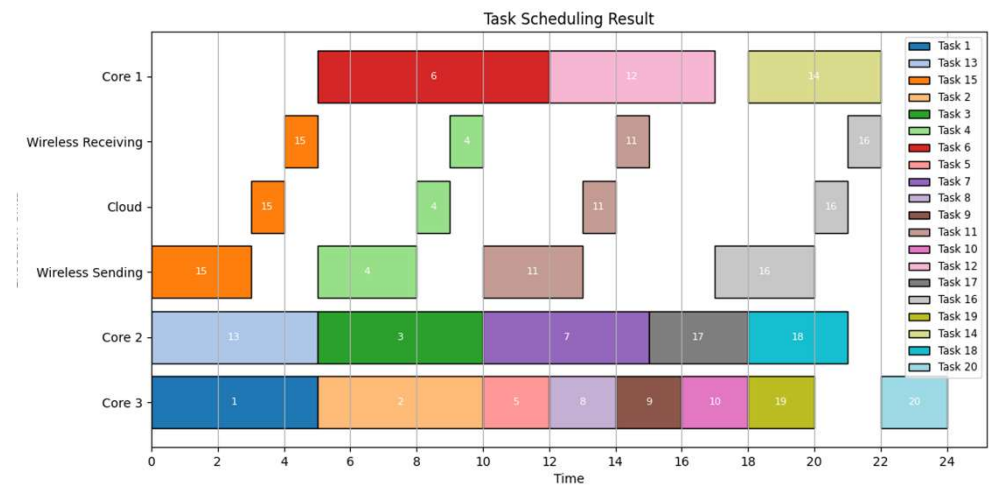
```

=== Task Scheduling Table ===
Task  Start Time  Finish Time  Location  Core
1      0           5           Core      3
13     0           5           Core      2
15     0           5           Cloud     -
2      5          10          Core      3
3      5          10          Core      2
4      5          10          Cloud     -
6      5          12          Core      1
5      10         12          Core      3
7      10         15          Core      2
8      12         14          Core      3
9      14         16          Core      3
11     10         15          Cloud     -
10     16         18          Core      3
12     12         17          Core      1
17     15         18          Core      2
16     17         22          Cloud     -
19     18         20          Core      3
14     18         22          Core      1
18     18         21          Core      2
20     22         24          Core      3
    
```

```

=== Energy Consumption ===
Core 1 Energy: 16
Core 2 Energy: 42
Core 3 Energy: 88
Cloud Energy: 6.0
Total Energy: 152.0
    
```

Initial scheduling result



$$T = 24$$

Energy consumption calculation:

$$E_1 = 1 \times 7 + 1 \times 5 + 1 \times 4 = 16$$

$$E_2 = 2 \times 5 + 2 \times 5 + 2 \times 5 + 2 \times 3 + 2 \times 3 = 42$$

$$E_3 = 4 \times 5 + 4 \times 5 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 = 88$$

$$E_{cloud} = 0.5 \times 3 \times 4 = 6$$

$$E_{TOTAL} = 20 + 28 + 100 + 6 = 152$$

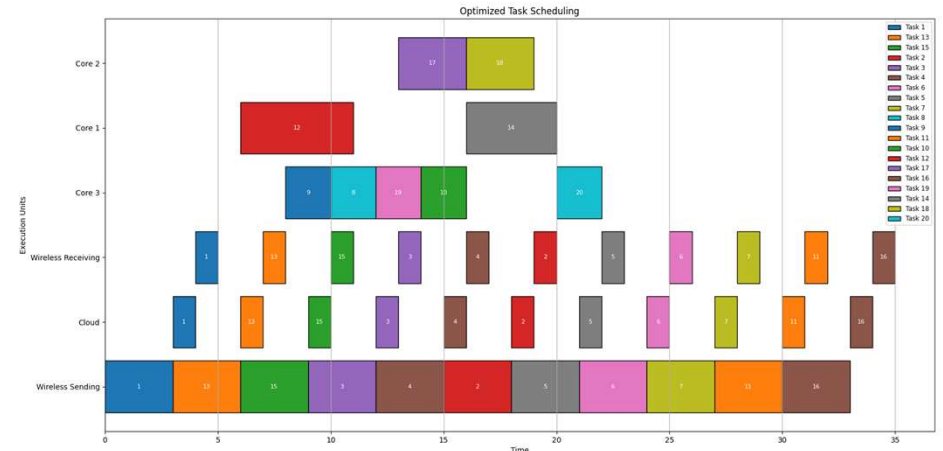
# Final Scheduling Result – Examples 4

Program Output

```

=== Task Scheduling Table ===
Task Start Time Finish Time Location Core
13 0 4 Core 3
1 4 9 Core 3
6 12 16 Core 3
2 9 14 Cloud -
3 9 14 Core 2
15 4 10 Core 1
4 9 12 Core 3
5 10 15 Core 1
7 14 19 Core 2
12 18 20 Core 3
8 16 18 Core 3
9 15 20 Core 1
11 14 19 Cloud -
20 22 24 Core 3
10 20 22 Core 3
17 19 22 Core 2
16 24 29 Cloud -
19 20 25 Core 1
14 24 27 Core 3
18 19 22 Core 2
    
```

Initial scheduling result



$$T_{max} = 36$$

Energy consumption calculation:

$$E_1 = 1 \times 5 + 1 \times 4 = 9$$

$$E_2 = 2 \times 3 + 2 \times 3 = 12$$

$$E_3 = 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 = 40$$

$$E_{cloud} = 0.5 \times 3 \times 11 = 16.5$$

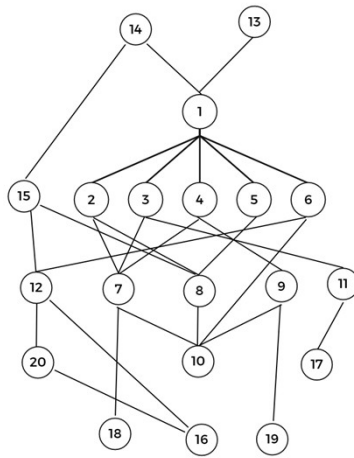
$$E_{TOTAL} = 9 + 12 + 40 + 16.5 = 77.5$$

Summary of T and E after optimize

$T_{Total}^{Initial}$	$T_{Total}^{Final}$	$E_{Total}^{Initial}$	$E_{Total}^{Final}$
24	35	152	77.5

# Input Examples 5

Task Graph



The directed graph was created using XMind. Since arrows cannot be used, the top-to-bottom connection means the top-to-bottom direction.

Execution Time Table

Task	Core1	Core2	Core3
1	9	7	5
2	8	6	5
3	6	5	4
4	7	5	3
5	5	4	2
6	7	6	4
7	8	5	3
8	6	4	2
9	5	3	2
10	7	4	2
11	8	3	2
12	5	3	2
13	6	5	4
14	4	4	3
15	6	6	5
16	6	6	5
17	4	3	2
18	4	3	2
19	5	4	2
20	8	4	2

Cloud scheduling time:

$$T_{send} = 3$$

$$T_{cloud} = 1$$

$$T_{receive} = 1$$

The power consumption of the kth core:

$$P_1 = 1$$

$$P_2 = 2$$

$$P_3 = 4$$

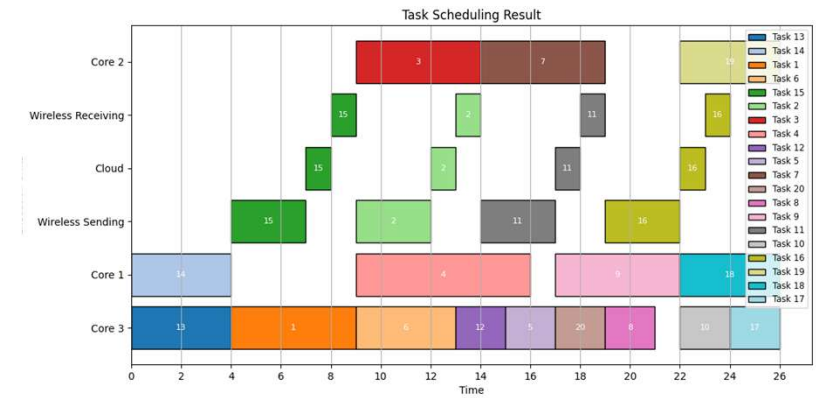
$$P_{RF} = 0.5$$

# Initial Scheduling Result – Examples 5

Initial scheduling result

=== Task Scheduling Table ===

Task	Start Time	Finish Time	Location	Core
13	0	4	Core	3
14	0	4	Core	1
1	4	9	Core	3
6	9	13	Core	3
15	4	9	Cloud	-
2	9	14	Cloud	-
3	9	14	Core	2
4	9	16	Core	1
12	13	15	Core	3
5	15	17	Core	3
7	14	19	Core	2
20	17	19	Core	3
8	19	21	Core	3
9	17	22	Core	1
11	14	19	Cloud	-
10	22	24	Core	3
16	19	24	Cloud	-
19	22	26	Core	2
18	22	26	Core	1
17	24	26	Core	3



$$T = 26$$

Energy consumption calculation:

$$E_1 = 1 \times 4 + 1 \times 7 + 1 \times 5 + 1 \times 4 = 20$$

$$E_2 = 2 \times 5 + 2 \times 5 + 2 \times 4 = 28$$

$$E_3 = 4 \times 4 + 4 \times 5 + 4 \times 4 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 = 100$$

$$E_{cloud} = 0.5 \times 3 \times 4 = 6$$

$$E_{TOTAL} = 20 + 28 + 100 + 6 = 154$$

=== Energy Consumption ===  
 Core 1 Energy: 20  
 Core 2 Energy: 28  
 Core 3 Energy: 100  
 Cloud Energy: 6.0  
 Total Energy: 154.0

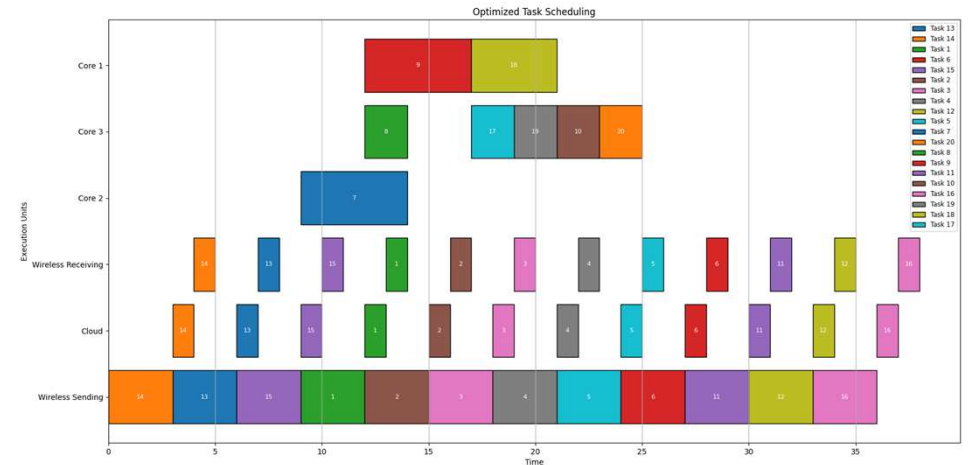
# Final Scheduling Result – Examples 5

Program Output

=== Task Scheduling Table ===

Task	Start Time	Finish Time	Location	Core
13	0	4	Core	3
14	0	4	Core	1
1	4	9	Core	3
6	9	13	Core	3
15	4	9	Cloud	-
2	9	14	Cloud	-
3	9	14	Core	2
4	9	16	Core	1
12	13	15	Core	3
5	15	17	Core	3
7	14	19	Core	2
20	17	19	Core	3
8	19	21	Core	3
9	17	22	Core	1
11	14	19	Cloud	-
10	22	24	Core	3
16	19	24	Cloud	-
19	22	26	Core	2
18	22	26	Core	1
17	24	26	Core	3

Initial scheduling result



$$T_{max} = 39$$

Energy consumption calculation:

$$E_1 = 1 \times 5 + 1 \times 4 = 9$$

$$E_2 = 2 \times 5 = 10$$

$$E_3 = 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 + 4 \times 2 = 40$$

$$E_{Cloud} = 0.5 \times 3 \times 12 = 18$$

$$E_{TOTAL} = 9 + 12 + 40 + 18 = 79$$

Summary of T and E after optimize

$T_{Total}^{Initial}$	$T_{Total}^{Final}$	$E_{Total}^{Initial}$	$E_{Total}^{Final}$
26	38	154	79