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# Dunaev Viktor

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## Lab 7

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### Pre - Task

```
In[659]:= fname = NotebookDirectory[] <> "input09.txt"
```

```
Out[659]= C:\Users\Виктор\Downloads\input09.txt
```

```
In[660]:= stream = OpenRead[fname]
```

```
Out[660]= InputStream[ Name: input09.txt  
Unique ID: 16]
```

```
In[661]:= t1 = AbsoluteTime[]
```

```
Out[661]= 3.7366261454082706 × 109
```

```
In[662]:= vertexNum = Read[stream, {Word, Number}] [[2]]
```

```
Out[662]= 150
```

```
In[663]:= edgesNum = Read[stream, {Word, Number}] [[2]]
```

```
Out[663]= 2000
```

```
In[664]:= edges = Table[#[[1]] ↔ #[[2]] &[ToExpression[Read[stream]]], edgesNum]
```

```
Out[664]= {1 ↔ 2, 1 ↔ 4, 1 ↔ 5, 1 ↔ 9, 1 ↔ 18, 1 ↔ 22, 1 ↔ 27, 1 ↔ 41, 1 ↔ 46, 1 ↔ 50, 1 ↔ 55,  
1 ↔ 66, 1 ↔ 67, 1 ↔ 71, 1 ↔ 107, 1 ↔ 145, 2 ↔ 11, 2 ↔ 20, 2 ↔ 22, 2 ↔ 23, 2 ↔ 29,  
2 ↔ 39, 2 ↔ 42, 2 ↔ 47, 2 ↔ 71, 2 ↔ 73, 2 ↔ 80, 2 ↔ 97, 2 ↔ 106, 2 ↔ 111, 2 ↔ 129,  
2 ↔ 142, 2 ↔ 144, 2 ↔ 149, 3 ↔ 8, 3 ↔ 32, 3 ↔ 51, 3 ↔ 72, 3 ↔ 73, 3 ↔ 74, 3 ↔ 75,  
3 ↔ 85, 3 ↔ 124, 3 ↔ 128, 3 ↔ 133, 3 ↔ 147, 4 ↔ 5, 4 ↔ 10, 4 ↔ 22, 4 ↔ 27, 4 ↔ 36,  
4 ↔ 53, 4 ↔ 74, 4 ↔ 85, 4 ↔ 88, 4 ↔ 117, 4 ↔ 118, 4 ↔ 121, 4 ↔ 130, 4 ↔ 131, 4 ↔ 135,  
5 ↔ 35, 5 ↔ 36, 5 ↔ 46, 5 ↔ 48, 5 ↔ 58, 5 ↔ 62, 5 ↔ 73, 5 ↔ 84, 5 ↔ 100, 5 ↔ 101,  
5 ↔ 102, 5 ↔ 104, 5 ↔ 119, 5 ↔ 124, 5 ↔ 128, 5 ↔ 144, 6 ↔ 1, 6 ↔ 7, 6 ↔ 38, 6 ↔ 42,  
6 ↔ 56, 6 ↔ 80, 6 ↔ 86, 6 ↔ 95, 6 ↔ 96, 6 ↔ 112, 6 ↔ 132, 7 ↔ 15, 7 ↔ 25, 7 ↔ 38,  
7 ↔ 44, 7 ↔ 47, 7 ↔ 60, 7 ↔ 93, 7 ↔ 95, 7 ↔ 101, 7 ↔ 106, 7 ↔ 145, 7 ↔ 147, 8 ↔ 19,  
8 ↔ 32, 8 ↔ 33, 8 ↔ 35, 8 ↔ 69, 8 ↔ 70, 8 ↔ 83, 8 ↔ 87, 8 ↔ 91, 8 ↔ 105, 8 ↔ 109,  
8 ↔ 111, 8 ↔ 121, 8 ↔ 122, 8 ↔ 127, 8 ↔ 130, 8 ↔ 134, 8 ↔ 146, 9 ↔ 33, 9 ↔ 39,  
9 ↔ 50, 9 ↔ 55, 9 ↔ 63, 9 ↔ 66, 9 ↔ 71, 9 ↔ 75, 9 ↔ 86, 9 ↔ 94, 9 ↔ 99, 9 ↔ 140,  
10 ↔ 7, 10 ↔ 17, 10 ↔ 22, 10 ↔ 44, 10 ↔ 75, 10 ↔ 84, 10 ↔ 99, 10 ↔ 106, 10 ↔ 129,  
11 ↔ 32, 11 ↔ 35, 11 ↔ 47, 11 ↔ 65, 11 ↔ 67, 11 ↔ 69, 11 ↔ 87, 11 ↔ 130, 11 ↔ 140,  
11 ↔ 146, 11 ↔ 147, 12 ↔ 4, 12 ↔ 8, 12 ↔ 11, 12 ↔ 16, 12 ↔ 24, 12 ↔ 67, 12 ↔ 104,  
12 ↔ 111, 12 ↔ 115, 12 ↔ 120, 12 ↔ 122, 12 ↔ 124, 12 ↔ 148, 13 ↔ 6, 13 ↔ 17,  
13 ↔ 19, 13 ↔ 25, 13 ↔ 29, 13 ↔ 48, 13 ↔ 65, 13 ↔ 82, 13 ↔ 90, 13 ↔ 97, 13 ↔ 120,  
13 ↔ 125, 13 ↔ 140, 13 ↔ 144, 14 ↔ 1, 14 ↔ 2, 14 ↔ 5, 14 ↔ 6, 14 ↔ 12, 14 ↔ 23,  
14 ↔ 43, 14 ↔ 44, 14 ↔ 63, 14 ↔ 70, 14 ↔ 79, 14 ↔ 80, 14 ↔ 100, 14 ↔ 137, 14 ↔ 145,  
14 ↔ 146, 15 ↔ 13, 15 ↔ 24, 15 ↔ 48, 15 ↔ 63, 15 ↔ 71, 15 ↔ 75, 15 ↔ 77, 15 ↔ 87,  
15 ↔ 101, 15 ↔ 106, 15 ↔ 115, 15 ↔ 123, 15 ↔ 141, 16 ↔ 1, 16 ↔ 6, 16 ↔ 26, 16 ↔ 29,  
16 ↔ 30, 16 ↔ 43, 16 ↔ 44, 16 ↔ 67, 16 ↔ 77, 16 ↔ 81, 16 ↔ 84, 16 ↔ 89, 16 ↔ 90,  
16 ↔ 91, 16 ↔ 103, 16 ↔ 121, 17 ↔ 4, 17 ↔ 20, 17 ↔ 33, 17 ↔ 83, 17 ↔ 90, 17 ↔ 91,
```

17 → 98, 17 → 108, 17 → 110, 17 → 149, 17 → 150, 18 → 14, 18 → 16, 18 → 31, 18 → 59, 18 → 79, 18 → 88, 18 → 92, 18 → 98, 18 → 102, 18 → 103, 18 → 105, 18 → 108, 18 → 117, 18 → 122, 18 → 137, 18 → 143, 19 → 6, 19 → 23, 19 → 33, 19 → 40, 19 → 82, 19 → 117, 19 → 121, 19 → 122, 19 → 137, 20 → 6, 20 → 12, 20 → 13, 20 → 14, 20 → 37, 20 → 39, 20 → 57, 20 → 85, 20 → 89, 20 → 95, 20 → 98, 20 → 99, 20 → 100, 20 → 107, 20 → 111, 20 → 133, 20 → 140, 20 → 143, 21 → 10, 21 → 16, 21 → 17, 21 → 18, 21 → 46, 21 → 83, 21 → 93, 21 → 103, 21 → 109, 21 → 113, 21 → 118, 21 → 119, 21 → 129, 21 → 144, 22 → 7, 22 → 52, 22 → 57, 22 → 82, 22 → 91, 22 → 97, 22 → 114, 22 → 123, 22 → 127, 22 → 150, 23 → 3, 23 → 15, 23 → 17, 23 → 24, 23 → 40, 23 → 45, 23 → 59, 23 → 60, 23 → 61, 23 → 90, 23 → 91, 23 → 93, 23 → 97, 23 → 105, 23 → 123, 24 → 39, 24 → 42, 24 → 43, 24 → 50, 24 → 54, 24 → 60, 24 → 61, 24 → 79, 24 → 85, 24 → 90, 24 → 96, 24 → 109, 24 → 113, 24 → 141, 25 → 44, 25 → 56, 25 → 74, 25 → 75, 25 → 87, 25 → 89, 25 → 92, 25 → 98, 25 → 103, 25 → 112, 25 → 118, 25 → 140, 25 → 150, 26 → 13, 26 → 14, 26 → 24, 26 → 40, 26 → 50, 26 → 64, 26 → 66, 26 → 71, 26 → 95, 26 → 105, 26 → 108, 26 → 117, 26 → 147, 27 → 7, 27 → 23, 27 → 39, 27 → 62, 27 → 68, 27 → 89, 27 → 97, 27 → 100, 27 → 101, 27 → 104, 27 → 140, 27 → 141, 27 → 144, 28 → 2, 28 → 18, 28 → 44, 28 → 48, 28 → 68, 28 → 75, 28 → 103, 28 → 126, 28 → 145, 29 → 4, 29 → 18, 29 → 33, 29 → 64, 29 → 71, 29 → 79, 29 → 88, 29 → 102, 29 → 111, 29 → 120, 29 → 129, 29 → 136, 29 → 150, 30 → 21, 30 → 36, 30 → 45, 30 → 62, 30 → 78, 30 → 109, 30 → 144, 31 → 10, 31 → 11, 31 → 15, 31 → 29, 31 → 33, 31 → 41, 31 → 42, 31 → 67, 31 → 83, 31 → 87, 31 → 125, 31 → 134, 32 → 17, 32 → 44, 32 → 51, 32 → 73, 32 → 75, 32 → 76, 32 → 89, 32 → 96, 32 → 136, 33 → 3, 33 → 27, 33 → 38, 33 → 47, 33 → 70, 33 → 75, 33 → 102, 33 → 103, 33 → 109, 33 → 140, 33 → 146, 33 → 149, 34 → 3, 34 → 5, 34 → 14, 34 → 39, 34 → 87, 34 → 90, 34 → 93, 34 → 110, 34 → 112, 34 → 119, 35 → 10, 35 → 14, 35 → 57, 35 → 94, 35 → 95, 35 → 100, 35 → 101, 35 → 109, 35 → 134, 35 → 138, 35 → 139, 35 → 150, 36 → 6, 36 → 8, 36 → 12, 36 → 20, 36 → 21, 36 → 27, 36 → 38, 36 → 48, 36 → 72, 36 → 111, 36 → 113, 36 → 122, 36 → 126, 37 → 1, 37 → 7, 37 → 9, 37 → 28, 37 → 46, 37 → 48, 37 → 51, 37 → 70, 37 → 95, 37 → 98, 37 → 119, 37 → 139, 37 → 146, 37 → 150, 38 → 18, 38 → 27, 38 → 28, 38 → 39, 38 → 64, 38 → 65, 38 → 72, 38 → 76, 38 → 90, 38 → 94, 38 → 104, 38 → 110, 38 → 123, 38 → 148, 39 → 1, 39 → 6, 39 → 8, 39 → 23, 39 → 26, 39 → 82, 39 → 87, 39 → 90, 39 → 97, 39 → 99, 39 → 101, 39 → 106, 39 → 110, 39 → 124, 39 → 139, 39 → 140, 40 → 2, 40 → 4, 40 → 7, 40 → 33, 40 → 44, 40 → 52, 40 → 55, 40 → 61, 40 → 92, 40 → 95, 40 → 104, 40 → 109, 40 → 127, 41 → 9, 41 → 16, 41 → 20, 41 → 42, 41 → 47, 41 → 58, 41 → 66, 41 → 69, 41 → 77, 41 → 85, 41 → 86, 41 → 94, 41 → 108, 41 → 120, 41 → 124, 41 → 128, 41 → 135, 41 → 144, 42 → 21, 42 → 23, 42 → 55, 42 → 63, 42 → 64, 42 → 73, 42 → 75, 42 → 90, 42 → 110, 43 → 8, 43 → 17, 43 → 54, 43 → 55, 43 → 66, 43 → 104, 43 → 109, 43 → 131, 43 → 132, 43 → 140, 43 → 146, 44 → 2, 44 → 8, 44 → 20, 44 → 23, 44 → 24, 44 → 36, 44 → 42, 44 → 57, 44 → 72, 44 → 84, 44 → 89, 44 → 116, 44 → 144, 45 → 8, 45 → 9, 45 → 34, 45 → 37, 45 → 40, 45 → 51, 45 → 57, 45 → 81, 45 → 84, 45 → 89, 45 → 100, 45 → 101, 45 → 104, 45 → 120, 45 → 121, 45 → 139, 45 → 142, 46 → 17, 46 → 47, 46 → 65, 46 → 73, 46 → 96, 46 → 99, 46 → 115, 46 → 127, 46 → 143, 46 → 150, 47 → 20, 47 → 22, 47 → 44, 47 → 45, 47 → 50, 47 → 59, 47 → 86, 47 → 112, 47 → 116, 47 → 122, 47 → 145, 48 → 20, 48 → 46, 48 → 51, 48 → 57, 48 → 78, 48 → 88, 48 → 91, 48 → 99, 48 → 110, 48 → 111, 48 → 115, 48 → 118, 48 → 124, 48 → 145, 48 → 150, 49 → 24, 49 → 25, 49 → 29, 49 → 51, 49 → 61, 49 → 69, 49 → 75, 49 → 82, 49 → 96, 49 → 99, 49 → 104, 49 → 106, 49 → 107, 49 → 115, 49 → 142, 49 → 146, 49 → 147, 50 → 5, 50 → 15, 50 → 31, 50 → 40, 50 → 48, 50 → 77, 50 → 92, 50 → 94, 50 → 116, 50 → 129, 50 → 140, 51 → 36, 51 → 62, 51 → 63, 51 → 78, 51 → 79, 51 → 87, 51 → 89, 51 → 123, 51 → 126, 51 → 143, 51 → 146, 51 → 149, 52 → 31, 52 → 87, 52 → 98, 52 → 120, 52 → 123, 52 → 126, 52 → 133, 52 → 139, 53 → 11, 53 → 49, 53 → 52, 53 → 58, 53 → 60, 53 → 83, 53 → 104, 53 → 129, 53 → 141, 53 → 142, 53 → 145, 54 → 8, 54 → 10, 54 → 20, 54 → 27, 54 → 29, 54 → 31, 54 → 39, 54 → 51, 54 → 68, 54 → 81, 54 → 86, 54 → 99, 54 → 116, 54 → 120, 54 → 126, 54 → 140, 55 → 6, 55 → 10, 55 → 22, 55 → 25, 55 → 41, 55 → 53, 55 → 54, 55 → 56, 55 → 63, 55 → 66, 55 → 84,

59 → 98, 59 → 102, 55 → 103, 55 → 112, 55 → 123, 55 → 124, 55 → 128, 56 → 2, 56 → 9, 56 → 21, 56 → 36, 56 → 57, 56 → 100, 56 → 111, 56 → 125, 56 → 126, 57 → 3, 57 → 4, 57 → 12, 57 → 62, 57 → 63, 57 → 67, 57 → 72, 57 → 74, 57 → 82, 57 → 92, 57 → 100, 57 → 109, 57 → 111, 57 → 114, 57 → 117, 57 → 118, 57 → 120, 57 → 137, 58 → 3, 58 → 18, 58 → 25, 58 → 27, 58 → 32, 58 → 35, 58 → 38, 58 → 42, 58 → 55, 58 → 56, 58 → 76, 58 → 85, 58 → 87, 58 → 93, 58 → 108, 58 → 117, 58 → 119, 58 → 134, 58 → 142, 59 → 9, 59 → 15, 59 → 16, 59 → 30, 59 → 36, 59 → 56, 59 → 63, 59 → 68, 59 → 73, 59 → 85, 59 → 94, 59 → 112, 59 → 114, 59 → 118, 59 → 125, 59 → 126, 59 → 144, 60 → 34, 60 → 39, 60 → 45, 60 → 50, 60 → 57, 60 → 79, 60 → 107, 60 → 109, 60 → 117, 60 → 125, 60 → 129, 61 → 8, 61 → 30, 61 → 31, 61 → 33, 61 → 68, 61 → 72, 61 → 110, 61 → 131, 61 → 135, 61 → 137, 61 → 146, 62 → 3, 62 → 15, 62 → 32, 62 → 36, 62 → 42, 62 → 47, 62 → 50, 62 → 52, 62 → 84, 62 → 85, 62 → 101, 62 → 103, 62 → 140, 62 → 141, 62 → 142, 62 → 148, 63 → 5, 63 → 12, 63 → 21, 63 → 26, 63 → 43, 63 → 50, 63 → 94, 63 → 100, 63 → 103, 63 → 108, 63 → 124, 63 → 131, 63 → 147, 64 → 4, 64 → 60, 64 → 66, 64 → 71, 64 → 75, 64 → 79, 64 → 80, 64 → 104, 64 → 113, 64 → 125, 64 → 127, 64 → 144, 64 → 146, 64 → 147, 65 → 32, 65 → 40, 65 → 49, 65 → 53, 65 → 66, 65 → 94, 65 → 123, 66 → 13, 66 → 17, 66 → 22, 66 → 34, 66 → 49, 66 → 93, 66 → 99, 66 → 101, 66 → 103, 66 → 104, 66 → 107, 66 → 112, 66 → 125, 67 → 26, 67 → 30, 67 → 45, 67 → 106, 67 → 117, 67 → 121, 67 → 134, 68 → 8, 68 → 17, 68 → 24, 68 → 62, 68 → 82, 68 → 88, 68 → 112, 68 → 116, 68 → 144, 69 → 17, 69 → 33, 69 → 34, 69 → 53, 69 → 57, 69 → 86, 69 → 89, 69 → 90, 69 → 96, 69 → 100, 69 → 113, 69 → 120, 69 → 123, 69 → 124, 69 → 125, 69 → 128, 70 → 2, 70 → 7, 70 → 22, 70 → 29, 70 → 57, 70 → 77, 70 → 90, 70 → 111, 70 → 119, 70 → 120, 70 → 125, 70 → 129, 70 → 140, 70 → 146, 71 → 18, 71 → 20, 71 → 31, 71 → 43, 71 → 53, 71 → 59, 71 → 67, 71 → 72, 71 → 87, 71 → 88, 71 → 106, 71 → 110, 71 → 111, 71 → 134, 71 → 140, 72 → 6, 72 → 7, 72 → 14, 72 → 15, 72 → 25, 72 → 26, 72 → 31, 72 → 41, 72 → 43, 72 → 46, 72 → 66, 72 → 74, 72 → 104, 72 → 108, 72 → 110, 72 → 114, 72 → 116, 72 → 121, 72 → 123, 72 → 126, 72 → 130, 72 → 138, 72 → 145, 73 → 4, 73 → 11, 73 → 29, 73 → 39, 73 → 41, 73 → 43, 73 → 49, 73 → 64, 73 → 67, 73 → 72, 73 → 87, 73 → 88, 73 → 96, 73 → 98, 73 → 105, 73 → 113, 73 → 115, 73 → 129, 73 → 137, 73 → 146, 74 → 45, 74 → 51, 74 → 79, 74 → 83, 74 → 91, 74 → 93, 74 → 107, 74 → 118, 74 → 122, 74 → 129, 75 → 1, 75 → 4, 75 → 8, 75 → 13, 75 → 23, 75 → 39, 75 → 58, 75 → 72, 75 → 78, 75 → 96, 75 → 106, 75 → 127, 75 → 129, 75 → 134, 75 → 144, 76 → 21, 76 → 23, 76 → 40, 76 → 45, 76 → 52, 76 → 67, 76 → 96, 76 → 100, 76 → 106, 76 → 109, 76 → 146, 76 → 149, 76 → 150, 77 → 11, 77 → 19, 77 → 34, 77 → 53, 77 → 63, 77 → 67, 77 → 68, 77 → 72, 77 → 78, 77 → 102, 77 → 105, 77 → 112, 77 → 115, 77 → 130, 77 → 143, 77 → 144, 78 → 10, 78 → 11, 78 → 15, 78 → 45, 78 → 66, 78 → 79, 78 → 85, 78 → 98, 78 → 106, 78 → 121, 78 → 129, 79 → 1, 79 → 19, 79 → 22, 79 → 46, 79 → 73, 79 → 106, 79 → 110, 79 → 124, 79 → 132, 79 → 133, 79 → 143, 80 → 37, 80 → 42, 80 → 52, 80 → 62, 80 → 83, 80 → 88, 80 → 89, 80 → 91, 80 → 97, 80 → 100, 80 → 122, 80 → 131, 80 → 143, 81 → 4, 81 → 11, 81 → 13, 81 → 53, 81 → 63, 81 → 70, 81 → 80, 81 → 111, 81 → 134, 81 → 137, 81 → 146, 82 → 2, 82 → 6, 82 → 9, 82 → 12, 82 → 34, 82 → 38, 82 → 53, 82 → 56, 82 → 78, 82 → 96, 82 → 99, 82 → 125, 82 → 147, 83 → 6, 83 → 9, 83 → 14, 83 → 19, 83 → 28, 83 → 35, 83 → 47, 83 → 99, 83 → 101, 83 → 109, 83 → 110, 83 → 113, 83 → 135, 83 → 136, 83 → 140, 84 → 8, 84 → 13, 84 → 25, 84 → 28, 84 → 36, 84 → 58, 84 → 59, 84 → 98, 84 → 106, 84 → 119, 84 → 124, 84 → 126, 84 → 136, 84 → 142, 85 → 7, 85 → 21, 85 → 23, 85 → 32, 85 → 46, 85 → 65, 85 → 71, 85 → 86, 85 → 92, 85 → 98, 85 → 104, 85 → 122, 85 → 139, 85 → 140, 86 → 13, 86 → 15, 86 → 24, 86 → 30, 86 → 32, 86 → 34, 86 → 73, 86 → 93, 86 → 100, 86 → 106, 86 → 109, 86 → 120, 86 → 121, 87 → 3, 87 → 16, 87 → 26, 87 → 44, 87 → 45, 87 → 50, 87 → 57, 87 → 66, 87 → 70, 87 → 81, 87 → 98, 87 → 102, 87 → 113, 87 → 115, 88 → 7, 88 → 14, 88 → 20, 88 → 39, 88 → 51, 88 → 81, 88 → 83, 88 → 85, 88 → 86, 88 → 120, 88 → 126, 88 → 134, 88 → 136, 88 → 139, 88 → 140, 88 → 142, 89 → 2, 89 → 4, 89 → 14, 89 → 18, 89 → 23, 89 → 24, 89 → 40, 89 → 43, 89 → 49, 89 → 66, 89 → 78, 90 → 2, 90 → 30, 90 → 65, 90 → 71, 90 → 78, 90 → 97, 90 → 99, 90 → 102,



```

122 ↔ 146, 123 ↔ 2, 123 ↔ 19, 123 ↔ 21, 123 ↔ 30, 123 ↔ 66, 123 ↔ 67, 123 ↔ 76,
123 ↔ 80, 123 ↔ 87, 123 ↔ 99, 123 ↔ 114, 123 ↔ 131, 123 ↔ 141, 124 ↔ 19, 124 ↔ 26,
124 ↔ 28, 124 ↔ 30, 124 ↔ 32, 124 ↔ 40, 124 ↔ 62, 124 ↔ 68, 124 ↔ 76, 124 ↔ 80,
124 ↔ 88, 124 ↔ 105, 124 ↔ 115, 124 ↔ 117, 124 ↔ 122, 124 ↔ 125, 125 ↔ 1, 125 ↔ 9,
125 ↔ 12, 125 ↔ 15, 125 ↔ 33, 125 ↔ 41, 125 ↔ 42, 125 ↔ 58, 125 ↔ 65, 125 ↔ 80,
125 ↔ 83, 125 ↔ 92, 125 ↔ 114, 125 ↔ 120, 126 ↔ 2, 126 ↔ 31, 126 ↔ 41, 126 ↔ 50,
126 ↔ 71, 126 ↔ 85, 126 ↔ 96, 126 ↔ 98, 126 ↔ 121, 126 ↔ 137, 127 ↔ 28, 127 ↔ 34,
127 ↔ 57, 127 ↔ 59, 127 ↔ 92, 127 ↔ 108, 127 ↔ 110, 127 ↔ 136, 127 ↔ 150, 128 ↔ 14,
128 ↔ 21, 128 ↔ 23, 128 ↔ 45, 128 ↔ 50, 128 ↔ 52, 128 ↔ 100, 128 ↔ 107, 128 ↔ 117,
128 ↔ 122, 128 ↔ 127, 128 ↔ 141, 129 ↔ 12, 129 ↔ 27, 129 ↔ 31, 129 ↔ 34, 129 ↔ 52,
129 ↔ 61, 129 ↔ 80, 129 ↔ 82, 129 ↔ 84, 129 ↔ 88, 129 ↔ 90, 129 ↔ 100, 129 ↔ 112,
129 ↔ 114, 129 ↔ 131, 129 ↔ 149, 130 ↔ 7, 130 ↔ 23, 130 ↔ 25, 130 ↔ 38, 130 ↔ 45,
130 ↔ 55, 130 ↔ 58, 130 ↔ 68, 130 ↔ 71, 130 ↔ 79, 130 ↔ 82, 130 ↔ 86, 130 ↔ 100,
130 ↔ 104, 130 ↔ 120, 130 ↔ 128, 130 ↔ 132, 130 ↔ 133, 130 ↔ 143, 130 ↔ 149,
131 ↔ 26, 131 ↔ 28, 131 ↔ 30, 131 ↔ 35, 131 ↔ 39, 131 ↔ 50, 131 ↔ 71, 131 ↔ 112,
131 ↔ 122, 131 ↔ 144, 131 ↔ 145, 132 ↔ 3, 132 ↔ 7, 132 ↔ 13, 132 ↔ 16, 132 ↔ 17,
132 ↔ 28, 132 ↔ 38, 132 ↔ 47, 132 ↔ 49, 132 ↔ 54, 132 ↔ 97, 132 ↔ 102, 132 ↔ 115,
132 ↔ 116, 132 ↔ 127, 132 ↔ 135, 133 ↔ 5, 133 ↔ 13, 133 ↔ 30, 133 ↔ 39, 133 ↔ 65,
133 ↔ 68, 133 ↔ 70, 134 ↔ 1, 134 ↔ 22, 134 ↔ 29, 134 ↔ 38, 134 ↔ 50, 134 ↔ 52,
134 ↔ 59, 134 ↔ 72, 134 ↔ 76, 134 ↔ 79, 134 ↔ 90, 134 ↔ 94, 134 ↔ 125, 134 ↔ 133,
135 ↔ 15, 135 ↔ 29, 135 ↔ 33, 135 ↔ 42, 135 ↔ 56, 135 ↔ 59, 135 ↔ 74, 135 ↔ 81,
135 ↔ 118, 135 ↔ 122, 135 ↔ 127, 135 ↔ 138, 135 ↔ 141, 135 ↔ 150, 136 ↔ 5, 136 ↔ 8,
136 ↔ 13, 136 ↔ 16, 136 ↔ 20, 136 ↔ 34, 136 ↔ 48, 136 ↔ 71, 136 ↔ 76, 136 ↔ 85,
136 ↔ 98, 136 ↔ 100, 136 ↔ 102, 136 ↔ 104, 136 ↔ 108, 136 ↔ 119, 136 ↔ 147,
137 ↔ 17, 137 ↔ 24, 137 ↔ 29, 137 ↔ 47, 137 ↔ 68, 137 ↔ 78, 137 ↔ 89, 137 ↔ 94,
137 ↔ 99, 137 ↔ 103, 137 ↔ 110, 137 ↔ 128, 137 ↔ 132, 137 ↔ 135, 137 ↔ 138,
138 ↔ 13, 138 ↔ 17, 138 ↔ 31, 138 ↔ 41, 138 ↔ 47, 138 ↔ 67, 138 ↔ 113, 138 ↔ 128,
138 ↔ 150, 139 ↔ 46, 139 ↔ 51, 139 ↔ 92, 139 ↔ 100, 140 ↔ 6, 140 ↔ 44, 140 ↔ 48,
140 ↔ 66, 140 ↔ 68, 140 ↔ 89, 140 ↔ 90, 140 ↔ 120, 140 ↔ 122, 140 ↔ 128, 140 ↔ 138,
141 ↔ 8, 141 ↔ 10, 141 ↔ 32, 141 ↔ 55, 141 ↔ 82, 141 ↔ 92, 141 ↔ 96, 141 ↔ 101,
141 ↔ 130, 142 ↔ 4, 142 ↔ 12, 142 ↔ 13, 142 ↔ 19, 142 ↔ 32, 142 ↔ 37, 142 ↔ 52,
142 ↔ 57, 142 ↔ 81, 142 ↔ 91, 142 ↔ 118, 142 ↔ 135, 143 ↔ 10, 143 ↔ 19, 143 ↔ 21,
143 ↔ 23, 143 ↔ 27, 143 ↔ 65, 143 ↔ 66, 143 ↔ 85, 143 ↔ 88, 143 ↔ 90, 143 ↔ 93,
143 ↔ 101, 143 ↔ 132, 144 ↔ 8, 144 ↔ 72, 144 ↔ 74, 144 ↔ 91, 144 ↔ 98, 144 ↔ 109,
144 ↔ 117, 144 ↔ 118, 144 ↔ 127, 144 ↔ 138, 144 ↔ 139, 145 ↔ 3, 145 ↔ 16, 145 ↔ 20,
145 ↔ 21, 145 ↔ 41, 145 ↔ 44, 145 ↔ 69, 145 ↔ 73, 145 ↔ 75, 145 ↔ 83, 145 ↔ 98,
145 ↔ 112, 145 ↔ 130, 145 ↔ 137, 145 ↔ 138, 146 ↔ 1, 146 ↔ 7, 146 ↔ 21, 146 ↔ 26,
146 ↔ 28, 146 ↔ 29, 146 ↔ 35, 146 ↔ 40, 146 ↔ 46, 146 ↔ 47, 146 ↔ 65, 146 ↔ 67,
146 ↔ 78, 146 ↔ 96, 146 ↔ 113, 146 ↔ 116, 146 ↔ 143, 146 ↔ 150, 147 ↔ 14,
147 ↔ 21, 147 ↔ 34, 147 ↔ 37, 147 ↔ 43, 147 ↔ 55, 147 ↔ 79, 147 ↔ 96, 147 ↔ 115,
147 ↔ 122, 147 ↔ 126, 147 ↔ 128, 147 ↔ 132, 147 ↔ 139, 147 ↔ 141, 148 ↔ 4, 148 ↔ 6,
148 ↔ 8, 148 ↔ 14, 148 ↔ 24, 148 ↔ 26, 148 ↔ 84, 148 ↔ 105, 148 ↔ 106, 148 ↔ 107,
148 ↔ 109, 148 ↔ 112, 148 ↔ 138, 149 ↔ 1, 149 ↔ 6, 149 ↔ 7, 149 ↔ 11, 149 ↔ 24,
149 ↔ 29, 149 ↔ 52, 149 ↔ 61, 149 ↔ 62, 149 ↔ 82, 149 ↔ 84, 149 ↔ 99, 149 ↔ 101,
149 ↔ 120, 149 ↔ 125, 149 ↔ 128, 149 ↔ 135, 149 ↔ 143, 150 ↔ 7, 150 ↔ 12, 150 ↔ 13,
150 ↔ 23, 150 ↔ 28, 150 ↔ 32, 150 ↔ 60, 150 ↔ 68, 150 ↔ 69, 150 ↔ 72, 150 ↔ 91,
150 ↔ 94, 150 ↔ 114, 150 ↔ 124, 150 ↔ 130, 150 ↔ 132, 150 ↔ 148, 150 ↔ 149}

```

```
In[665]:= vertex = Table[i, {i, 1, vertexNum}]
```



```
In[672]:= pred = Table[0, Length[vertex]]
```

[illegible]

```
In[673]:= depth = Table[0, Length[vertex]]
```

[illegible]

```
In[674]:= t8 = AbsoluteTime[]
```

Out[674]=  $3.7366261458295053 \times 10^9$

```
In[675]:= t2 = AbsoluteTime[]
```

Out[675]=  $3.7366261458429564 \times 10^9$

```
In[676]:= {tree, graphTree, dinast} = Flatten[
```

Reap[

## DepthFirstScan[

### UndirectedGraph @ g, startNode,

```

{"FrontierEdge" → ((edge = # /. (x_  $\rightarrow$  y_) → (x  $\rightarrow$  y); Sow[edge, RT];

```

```
If[MemberQ[edges, edge], dirs[[#][2]] = 1;
```

```
Sow[edge, ST], dirs[[#][2]] = -1;
```

```
Sow[Reverse[edge], ST];
```

```
pred[#[2]] = #[1];
```

```
depth[#[2]] = depth[#[1]] + 1) &), "PrevisitVertex" -> ((Sow[#, DT] &)),
```

 $\{\mathbf{RT}, \mathbf{ST}, \mathbf{DT}\}[\mathbb{I}2], 1]$

```

Out[676]= {{145 ↔ 1, 1 ↔ 6, 6 ↔ 13, 13 ↔ 15, 15 ↔ 7, 7 ↔ 10, 10 ↔ 4, 4 ↔ 12, 12 ↔ 14, 14 ↔ 18, 18 ↔ 21,
21 ↔ 30, 30 ↔ 16, 16 ↔ 41, 41 ↔ 31, 31 ↔ 50, 50 ↔ 9, 9 ↔ 37, 37 ↔ 20, 20 ↔ 2, 2 ↔ 28,
28 ↔ 38, 38 ↔ 33, 33 ↔ 8, 8 ↔ 3, 3 ↔ 23, 23 ↔ 19, 19 ↔ 77, 77 ↔ 70, 70 ↔ 81, 81 ↔ 45,
45 ↔ 47, 47 ↔ 11, 11 ↔ 53, 53 ↔ 55, 55 ↔ 40, 40 ↔ 26, 26 ↔ 39, 39 ↔ 24, 24 ↔ 44, 44 ↔ 25,
25 ↔ 49, 49 ↔ 65, 65 ↔ 46, 46 ↔ 5, 5 ↔ 34, 34 ↔ 60, 60 ↔ 64, 64 ↔ 29, 29 ↔ 54, 54 ↔ 43,
43 ↔ 63, 63 ↔ 42, 42 ↔ 58, 58 ↔ 75, 75 ↔ 32, 32 ↔ 62, 62 ↔ 27, 27 ↔ 36, 36 ↔ 51, 51 ↔ 48,
48 ↔ 92, 92 ↔ 57, 57 ↔ 22, 22 ↔ 66, 66 ↔ 72, 72 ↔ 61, 61 ↔ 107, 107 ↔ 74, 74 ↔ 95, 95 ↔ 35,
35 ↔ 83, 83 ↔ 17, 17 ↔ 68, 68 ↔ 59, 59 ↔ 71, 71 ↔ 85, 85 ↔ 78, 78 ↔ 82, 82 ↔ 100, 100 ↔ 56,
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140, 89, 137, 121, 126, 147, 115, 122, 128, 138, 135, 142, 118, 143, 146, 108, 149, 141, 148, 139, 133}}

```

```
In[677]:= t2 = AbsoluteTime[] - t2
```

```
Out[677]= 0.1205858
```

## Нахождение любого частного решения.

```
In[678]:= t4 = AbsoluteTime[]
```

```
Out[678]= 3.7366261459762818 × 109
```



```
In[679]:= (z#[[1]],#[[2]] = 0) & /@ edges
```

[illegible]



15  $\rightarrow$  63, 15  $\rightarrow$  71, 15  $\rightarrow$  75, 15  $\rightarrow$  77, 15  $\rightarrow$  87, 15  $\rightarrow$  101, 15  $\rightarrow$  106, 15  $\rightarrow$  115, 15  $\rightarrow$  123, 15  $\rightarrow$  141, 16  $\rightarrow$  1, 16  $\rightarrow$  6, 16  $\rightarrow$  26, 16  $\rightarrow$  29, 16  $\rightarrow$  43, 16  $\rightarrow$  44, 16  $\rightarrow$  67, 16  $\rightarrow$  77, 16  $\rightarrow$  81, 16  $\rightarrow$  84, 16  $\rightarrow$  89, 16  $\rightarrow$  90, 16  $\rightarrow$  91, 16  $\rightarrow$  103, 16  $\rightarrow$  121, 17  $\rightarrow$  4, 17  $\rightarrow$  20, 17  $\rightarrow$  33, 17  $\rightarrow$  90, 17  $\rightarrow$  91, 17  $\rightarrow$  98, 17  $\rightarrow$  108, 17  $\rightarrow$  110, 17  $\rightarrow$  149, 17  $\rightarrow$  150, 18  $\rightarrow$  16, 18  $\rightarrow$  31, 18  $\rightarrow$  59, 18  $\rightarrow$  79, 18  $\rightarrow$  88, 18  $\rightarrow$  92, 18  $\rightarrow$  98, 18  $\rightarrow$  102, 18  $\rightarrow$  103, 18  $\rightarrow$  105, 18  $\rightarrow$  108, 18  $\rightarrow$  117, 18  $\rightarrow$  122, 18  $\rightarrow$  137, 18  $\rightarrow$  143, 19  $\rightarrow$  6, 19  $\rightarrow$  33, 19  $\rightarrow$  40, 19  $\rightarrow$  82, 19  $\rightarrow$  117, 19  $\rightarrow$  121, 19  $\rightarrow$  122, 19  $\rightarrow$  137, 20  $\rightarrow$  6, 20  $\rightarrow$  12, 20  $\rightarrow$  13, 20  $\rightarrow$  14, 20  $\rightarrow$  39, 20  $\rightarrow$  57, 20  $\rightarrow$  85, 20  $\rightarrow$  89, 20  $\rightarrow$  95, 20  $\rightarrow$  98, 20  $\rightarrow$  99, 20  $\rightarrow$  100, 20  $\rightarrow$  107, 20  $\rightarrow$  111, 20  $\rightarrow$  133, 20  $\rightarrow$  140, 20  $\rightarrow$  143, 21  $\rightarrow$  10, 21  $\rightarrow$  16, 21  $\rightarrow$  17, 21  $\rightarrow$  46, 21  $\rightarrow$  83, 21  $\rightarrow$  93, 21  $\rightarrow$  103, 21  $\rightarrow$  109, 21  $\rightarrow$  113, 21  $\rightarrow$  118, 21  $\rightarrow$  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123 → 114, 123 → 131, 123 → 141, 124 → 19, 124 → 26, 124 → 28, 124 → 30, 124 → 32,  
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124 → 117, 124 → 122, 125 → 1, 125 → 9, 125 → 12, 125 → 15, 125 → 33, 125 → 41,  
125 → 42, 125 → 58, 125 → 65, 125 → 80, 125 → 83, 125 → 92, 125 → 120, 126 → 2,  
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129  $\leftrightarrow$  61, 129  $\leftrightarrow$  80, 129  $\leftrightarrow$  82, 129  $\leftrightarrow$  84, 129  $\leftrightarrow$  88, 129  $\leftrightarrow$  90, 129  $\leftrightarrow$  100, 129  $\leftrightarrow$  114,  
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 131  $\leftrightarrow$  39, 131  $\leftrightarrow$  50, 131  $\leftrightarrow$  71, 131  $\leftrightarrow$  112, 131  $\leftrightarrow$  122, 131  $\leftrightarrow$  145, 132  $\leftrightarrow$  3, 132  $\leftrightarrow$  7,  
 132  $\leftrightarrow$  13, 132  $\leftrightarrow$  16, 132  $\leftrightarrow$  17, 132  $\leftrightarrow$  28, 132  $\leftrightarrow$  38, 132  $\leftrightarrow$  47, 132  $\leftrightarrow$  49, 132  $\leftrightarrow$  54,  
 132  $\leftrightarrow$  102, 132  $\leftrightarrow$  115, 132  $\leftrightarrow$  116, 132  $\leftrightarrow$  127, 132  $\leftrightarrow$  135, 133  $\leftrightarrow$  5, 133  $\leftrightarrow$  13, 133  $\leftrightarrow$  30,  
 133  $\leftrightarrow$  39, 133  $\leftrightarrow$  65, 133  $\leftrightarrow$  68, 133  $\leftrightarrow$  70, 134  $\leftrightarrow$  1, 134  $\leftrightarrow$  22, 134  $\leftrightarrow$  29, 134  $\leftrightarrow$  38,  
 134  $\leftrightarrow$  50, 134  $\leftrightarrow$  52, 134  $\leftrightarrow$  59, 134  $\leftrightarrow$  72, 134  $\leftrightarrow$  76, 134  $\leftrightarrow$  79, 134  $\leftrightarrow$  90, 134  $\leftrightarrow$  125,  
 134  $\leftrightarrow$  133, 135  $\leftrightarrow$  15, 135  $\leftrightarrow$  29, 135  $\leftrightarrow$  33, 135  $\leftrightarrow$  42, 135  $\leftrightarrow$  56, 135  $\leftrightarrow$  59, 135  $\leftrightarrow$  74,  
 135  $\leftrightarrow$  81, 135  $\leftrightarrow$  118, 135  $\leftrightarrow$  122, 135  $\leftrightarrow$  127, 135  $\leftrightarrow$  150, 136  $\leftrightarrow$  5, 136  $\leftrightarrow$  8, 136  $\leftrightarrow$  13,  
 136  $\leftrightarrow$  16, 136  $\leftrightarrow$  20, 136  $\leftrightarrow$  34, 136  $\leftrightarrow$  48, 136  $\leftrightarrow$  71, 136  $\leftrightarrow$  76, 136  $\leftrightarrow$  85, 136  $\leftrightarrow$  98,  
 136  $\leftrightarrow$  100, 136  $\leftrightarrow$  102, 136  $\leftrightarrow$  104, 136  $\leftrightarrow$  108, 136  $\leftrightarrow$  147, 137  $\leftrightarrow$  17, 137  $\leftrightarrow$  24,  
 137  $\leftrightarrow$  29, 137  $\leftrightarrow$  47, 137  $\leftrightarrow$  68, 137  $\leftrightarrow$  78, 137  $\leftrightarrow$  94, 137  $\leftrightarrow$  99, 137  $\leftrightarrow$  103, 137  $\leftrightarrow$  110,  
 137  $\leftrightarrow$  128, 137  $\leftrightarrow$  132, 137  $\leftrightarrow$  135, 137  $\leftrightarrow$  138, 138  $\leftrightarrow$  13, 138  $\leftrightarrow$  17, 138  $\leftrightarrow$  31,  
 138  $\leftrightarrow$  41, 138  $\leftrightarrow$  47, 138  $\leftrightarrow$  67, 138  $\leftrightarrow$  113, 138  $\leftrightarrow$  150, 139  $\leftrightarrow$  46, 139  $\leftrightarrow$  51, 139  $\leftrightarrow$  92,  
 139  $\leftrightarrow$  100, 140  $\leftrightarrow$  6, 140  $\leftrightarrow$  44, 140  $\leftrightarrow$  48, 140  $\leftrightarrow$  66, 140  $\leftrightarrow$  68, 140  $\leftrightarrow$  90, 140  $\leftrightarrow$  122,  
 140  $\leftrightarrow$  128, 140  $\leftrightarrow$  138, 141  $\leftrightarrow$  8, 141  $\leftrightarrow$  10, 141  $\leftrightarrow$  32, 141  $\leftrightarrow$  55, 141  $\leftrightarrow$  82, 141  $\leftrightarrow$  92,  
 141  $\leftrightarrow$  96, 141  $\leftrightarrow$  101, 141  $\leftrightarrow$  130, 142  $\leftrightarrow$  4, 142  $\leftrightarrow$  12, 142  $\leftrightarrow$  13, 142  $\leftrightarrow$  19, 142  $\leftrightarrow$  32,  
 142  $\leftrightarrow$  37, 142  $\leftrightarrow$  52, 142  $\leftrightarrow$  57, 142  $\leftrightarrow$  81, 142  $\leftrightarrow$  91, 143  $\leftrightarrow$  10, 143  $\leftrightarrow$  19, 143  $\leftrightarrow$  21,  
 143  $\leftrightarrow$  23, 143  $\leftrightarrow$  27, 143  $\leftrightarrow$  65, 143  $\leftrightarrow$  66, 143  $\leftrightarrow$  85, 143  $\leftrightarrow$  88, 143  $\leftrightarrow$  90, 143  $\leftrightarrow$  93,  
 143  $\leftrightarrow$  101, 143  $\leftrightarrow$  132, 144  $\leftrightarrow$  8, 144  $\leftrightarrow$  72, 144  $\leftrightarrow$  74, 144  $\leftrightarrow$  91, 144  $\leftrightarrow$  98, 144  $\leftrightarrow$  117,  
 144  $\leftrightarrow$  118, 144  $\leftrightarrow$  127, 144  $\leftrightarrow$  138, 144  $\leftrightarrow$  139, 145  $\leftrightarrow$  3, 145  $\leftrightarrow$  16, 145  $\leftrightarrow$  20, 145  $\leftrightarrow$  21,  
 145  $\leftrightarrow$  41, 145  $\leftrightarrow$  44, 145  $\leftrightarrow$  69, 145  $\leftrightarrow$  73, 145  $\leftrightarrow$  75, 145  $\leftrightarrow$  83, 145  $\leftrightarrow$  98, 145  $\leftrightarrow$  112,  
 145  $\leftrightarrow$  130, 145  $\leftrightarrow$  137, 145  $\leftrightarrow$  138, 146  $\leftrightarrow$  1, 146  $\leftrightarrow$  7, 146  $\leftrightarrow$  21, 146  $\leftrightarrow$  26, 146  $\leftrightarrow$  28,  
 146  $\leftrightarrow$  29, 146  $\leftrightarrow$  35, 146  $\leftrightarrow$  40, 146  $\leftrightarrow$  46, 146  $\leftrightarrow$  47, 146  $\leftrightarrow$  65, 146  $\leftrightarrow$  67, 146  $\leftrightarrow$  78,  
 146  $\leftrightarrow$  96, 146  $\leftrightarrow$  113, 146  $\leftrightarrow$  116, 146  $\leftrightarrow$  150, 147  $\leftrightarrow$  14, 147  $\leftrightarrow$  21, 147  $\leftrightarrow$  34, 147  $\leftrightarrow$  37,  
 147  $\leftrightarrow$  43, 147  $\leftrightarrow$  55, 147  $\leftrightarrow$  79, 147  $\leftrightarrow$  96, 147  $\leftrightarrow$  122, 147  $\leftrightarrow$  128, 147  $\leftrightarrow$  132, 147  $\leftrightarrow$  139,  
 147  $\leftrightarrow$  141, 148  $\leftrightarrow$  4, 148  $\leftrightarrow$  6, 148  $\leftrightarrow$  8, 148  $\leftrightarrow$  14, 148  $\leftrightarrow$  24, 148  $\leftrightarrow$  26, 148  $\leftrightarrow$  84,  
 148  $\leftrightarrow$  105, 148  $\leftrightarrow$  106, 148  $\leftrightarrow$  107, 148  $\leftrightarrow$  109, 148  $\leftrightarrow$  112, 149  $\leftrightarrow$  1, 149  $\leftrightarrow$  6, 149  $\leftrightarrow$  7,  
 149  $\leftrightarrow$  11, 149  $\leftrightarrow$  24, 149  $\leftrightarrow$  29, 149  $\leftrightarrow$  52, 149  $\leftrightarrow$  61, 149  $\leftrightarrow$  62, 149  $\leftrightarrow$  82, 149  $\leftrightarrow$  84,  
 149  $\leftrightarrow$  99, 149  $\leftrightarrow$  101, 149  $\leftrightarrow$  120, 149  $\leftrightarrow$  125, 149  $\leftrightarrow$  128, 149  $\leftrightarrow$  135, 150  $\leftrightarrow$  7, 150  $\leftrightarrow$  12,  
 150  $\leftrightarrow$  13, 150  $\leftrightarrow$  23, 150  $\leftrightarrow$  28, 150  $\leftrightarrow$  32, 150  $\leftrightarrow$  60, 150  $\leftrightarrow$  68, 150  $\leftrightarrow$  69, 150  $\leftrightarrow$  72,  
 150  $\leftrightarrow$  91, 150  $\leftrightarrow$  94, 150  $\leftrightarrow$  114, 150  $\leftrightarrow$  130, 150  $\leftrightarrow$  132, 150  $\leftrightarrow$  148, 150  $\leftrightarrow$  149}

In[687]:= **Ut = graphTree**

Out[687]:= { 1  $\leftrightarrow$  145, 6  $\leftrightarrow$  1, 13  $\leftrightarrow$  6, 15  $\leftrightarrow$  13, 7  $\leftrightarrow$  15, 10  $\leftrightarrow$  7, 4  $\leftrightarrow$  10, 12  $\leftrightarrow$  4, 14  $\leftrightarrow$  12, 18  $\leftrightarrow$  14,  
 21  $\leftrightarrow$  18, 30  $\leftrightarrow$  21, 16  $\leftrightarrow$  30, 41  $\leftrightarrow$  16, 31  $\leftrightarrow$  41, 50  $\leftrightarrow$  31, 9  $\leftrightarrow$  50, 37  $\leftrightarrow$  9, 20  $\leftrightarrow$  37,  
 2  $\leftrightarrow$  20, 28  $\leftrightarrow$  2, 38  $\leftrightarrow$  28, 33  $\leftrightarrow$  38, 8  $\leftrightarrow$  33, 3  $\leftrightarrow$  8, 23  $\leftrightarrow$  3, 19  $\leftrightarrow$  23, 77  $\leftrightarrow$  19, 70  $\leftrightarrow$  77,  
 81  $\leftrightarrow$  70, 45  $\leftrightarrow$  81, 47  $\leftrightarrow$  45, 11  $\leftrightarrow$  47, 53  $\leftrightarrow$  11, 55  $\leftrightarrow$  53, 40  $\leftrightarrow$  55, 26  $\leftrightarrow$  40, 39  $\leftrightarrow$  26,  
 24  $\leftrightarrow$  39, 44  $\leftrightarrow$  24, 25  $\leftrightarrow$  44, 49  $\leftrightarrow$  25, 65  $\leftrightarrow$  49, 46  $\leftrightarrow$  65, 5  $\leftrightarrow$  46, 34  $\leftrightarrow$  5, 60  $\leftrightarrow$  34,  
 64  $\leftrightarrow$  60, 29  $\leftrightarrow$  64, 54  $\leftrightarrow$  29, 43  $\leftrightarrow$  54, 63  $\leftrightarrow$  43, 42  $\leftrightarrow$  63, 58  $\leftrightarrow$  42, 75  $\leftrightarrow$  58, 32  $\leftrightarrow$  75,  
 62  $\leftrightarrow$  32, 27  $\leftrightarrow$  62, 36  $\leftrightarrow$  27, 51  $\leftrightarrow$  36, 48  $\leftrightarrow$  51, 92  $\leftrightarrow$  48, 57  $\leftrightarrow$  92, 22  $\leftrightarrow$  57, 66  $\leftrightarrow$  22,  
 72  $\leftrightarrow$  66, 61  $\leftrightarrow$  72, 107  $\leftrightarrow$  61, 74  $\leftrightarrow$  107, 95  $\leftrightarrow$  74, 35  $\leftrightarrow$  95, 83  $\leftrightarrow$  35, 17  $\leftrightarrow$  83, 68  $\leftrightarrow$  17,  
 59  $\leftrightarrow$  68, 71  $\leftrightarrow$  59, 85  $\leftrightarrow$  71, 78  $\leftrightarrow$  85, 82  $\leftrightarrow$  78, 100  $\leftrightarrow$  82, 56  $\leftrightarrow$  100, 113  $\leftrightarrow$  56,  
 69  $\leftrightarrow$  113, 105  $\leftrightarrow$  69, 73  $\leftrightarrow$  105, 79  $\leftrightarrow$  73, 102  $\leftrightarrow$  79, 87  $\leftrightarrow$  102, 52  $\leftrightarrow$  87, 76  $\leftrightarrow$  52,  
 93  $\leftrightarrow$  76, 86  $\leftrightarrow$  93, 88  $\leftrightarrow$  86, 80  $\leftrightarrow$  88, 123  $\leftrightarrow$  80, 101  $\leftrightarrow$  123, 99  $\leftrightarrow$  101, 90  $\leftrightarrow$  99,  
 111  $\leftrightarrow$  90, 96  $\leftrightarrow$  111, 112  $\leftrightarrow$  96, 129  $\leftrightarrow$  112, 94  $\leftrightarrow$  129, 134  $\leftrightarrow$  94, 67  $\leftrightarrow$  134, 104  $\leftrightarrow$  67,  
 91  $\leftrightarrow$  104, 117  $\leftrightarrow$  91, 103  $\leftrightarrow$  117, 98  $\leftrightarrow$  103, 84  $\leftrightarrow$  98, 116  $\leftrightarrow$  84, 106  $\leftrightarrow$  116, 97  $\leftrightarrow$  106,  
 132  $\leftrightarrow$  97, 130  $\leftrightarrow$  132, 114  $\leftrightarrow$  130, 125  $\leftrightarrow$  114, 124  $\leftrightarrow$  125, 150  $\leftrightarrow$  124, 119  $\leftrightarrow$  150,  
 136  $\leftrightarrow$  119, 109  $\leftrightarrow$  136, 144  $\leftrightarrow$  109, 131  $\leftrightarrow$  144, 110  $\leftrightarrow$  131, 127  $\leftrightarrow$  110, 120  $\leftrightarrow$  127,  
 140  $\leftrightarrow$  120, 140  $\leftrightarrow$  89, 137  $\leftrightarrow$  89, 121  $\leftrightarrow$  137, 126  $\leftrightarrow$  121, 147  $\leftrightarrow$  126, 147  $\leftrightarrow$  115,  
 122  $\leftrightarrow$  115, 128  $\leftrightarrow$  122, 138  $\leftrightarrow$  128, 135  $\leftrightarrow$  138, 142  $\leftrightarrow$  135, 142  $\leftrightarrow$  118, 118  $\leftrightarrow$  143,  
 146  $\leftrightarrow$  143, 108  $\leftrightarrow$  146, 149  $\leftrightarrow$  143, 135  $\leftrightarrow$  141, 148  $\leftrightarrow$  138, 122  $\leftrightarrow$  139, 130  $\leftrightarrow$  133}

In[688]:= **t3 = AbsoluteTime[]**

Out[688]=  $3.7366261465604042 \times 10^9$

```
In[689]:= deltas = Reap[For[i = 1, i ≤ Length[Un], i++,
  τ = Un[[i]][1];
  ρ = Un[[i]][2];
  δ̃ = 0;
  Sow[δUn[[i]][1], Un[[i]][2] -> dirs[τ] * δ̃];
  If[depth[τ] > depth[ρ], δ̃ = 1, τ = Un[[i]][2]; ρ = Un[[i]][1]; δ̃ = -1];
  depthDelta = depth[τ] - depth[ρ];
  For[j = 0, j < depthDelta, j++,
    ver = pred[τ];
    If[dirs[τ] > 0, rib = ver ↔ τ, rib = τ ↔ ver];
    Sow[δUn[[i]][1], rib[[2]] -> dirs[τ] * δ̃];
    τ = ver;
  ];
  If[τ ≠ ρ,
    While[True,
      predT = pred[τ];
      predRho = pred[ρ];
      If[dirs[τ] > 0, ribT = predT ↔ τ, ribT = τ ↔ predT];
      If[dirs[ρ] > 0, ribRho = predRho ↔ ρ, ribRho = ρ ↔ predRho];
      Sow[δUn[[i]][1], ribT[[2]] -> dirs[τ] * δ̃];
      Sow[δUn[[i]][1], ribRho[[2]] -> dirs[ρ] * δ̃ * -1];
      τ = predT;
      ρ = predRho;
      If[τ == ρ, Break[]]
    ]
  ]
] // Flatten // Dispatch
```

Out[689]= Dispatch[

In[690]:= **t3 = AbsoluteTime[] - t3**

Out[690]= 7.9066438

In[691]:= **unLen = Length[Un]**

Out[691]= 1851

In[692]:= **t5 = AbsoluteTime[]**

Out[692]=  $3.7366261545005697 \times 10^9$

In[693]:= **zeroDelta = (δ<sup>d<sub>a-</sub>→e<sub>b-</sub></sup>) → 0 // Dispatch**

Out[693]= Dispatch[





```
In[701]:= t7 = AbsoluteTime[]
```

Out[701]=  $3.7366262251356668 \times 10^9$

```
In[702]:= sol = Solve[sys]
```

Out[702]=

[show less](#)[show all](#)[show all](#)

## set size limit...

```
In[703]:= sys /. sol
```

[illegible]

```
In[704]:= t7 = AbsoluteTime[] - t7
```

Out[704]= 1.5058771

```
In[705]:= TableForm[{{t1, t2, t3, t4, t5, t6, t7, t8}},  
  TableHeadings -> {None, {"t1", "t2", "t3", "t4", "t5", "t6", "t7", "t8"}}]
```

Out[705]//TableForm=

t1	t2	t3	t4	t5	t6	t7
0.3335216	0.1205858	7.9066438	0.2926922	12.3077840	57.5523526	1.505877