Constraint Satisfaction Problems/Programming

A4B33ZUI, LS 2016/2017

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Baseline Algorithm

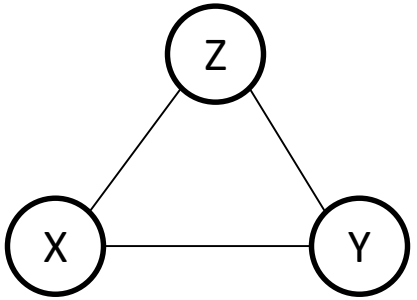
```
function BACKTRACKING-SEARCH(csp) returns solution/failure
    return RECURSIVE-BACKTRACKING({ }, csp)

function RECURSIVE-BACKTRACKING(assignment, csp) returns soln/failure
    if assignment is complete then return assignment
    var ← SELECT-UNASSIGNED-VARIABLE(VARIABLES[csp], assignment, csp)
    for each value in ORDER-DOMAIN-VALUES(var, assignment, csp) do
        if value is consistent with assignment given CONSTRAINTS[csp] then
            add {var = value} to assignment
            result ← RECURSIVE-BACKTRACKING(assignment, csp)
            if result ≠ failure then return result
            remove {var = value} from assignment
    return failure
```

CSP Missing Steps

- heuristics
  - Minimal Remaining Values
  - Least Constraining Value

CSP Missing Steps

- AC-3 (and other) algorithm assumes binary constraints
- binarization of constraints



  - X + Y = Z
  - X in [1..3], Y in [2..4], Z in [3..7]

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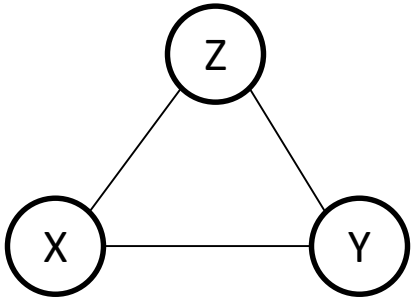

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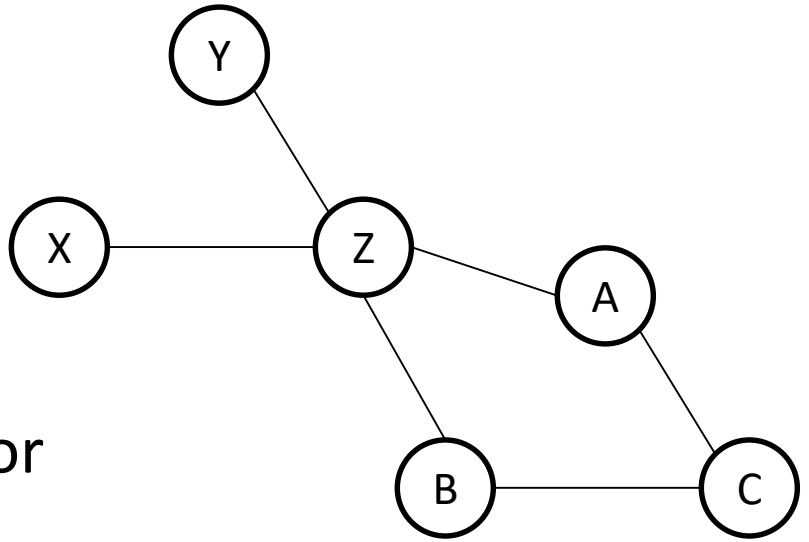
- we define new variable U in [{1,2,3}; {1,3,4}; …]

CSP Missing Steps

- Backjumping
  - consider a graph coloring problem
  - consider the following ordering of variables
    - A,B,C,X,Y,Z
- we can jump directly to the cause for backtracking



CSP – optimization variant

- What if we do not want an arbitrary solution that satisfies the constraints?
- We optimize some objective function
- How would the algorithm change?