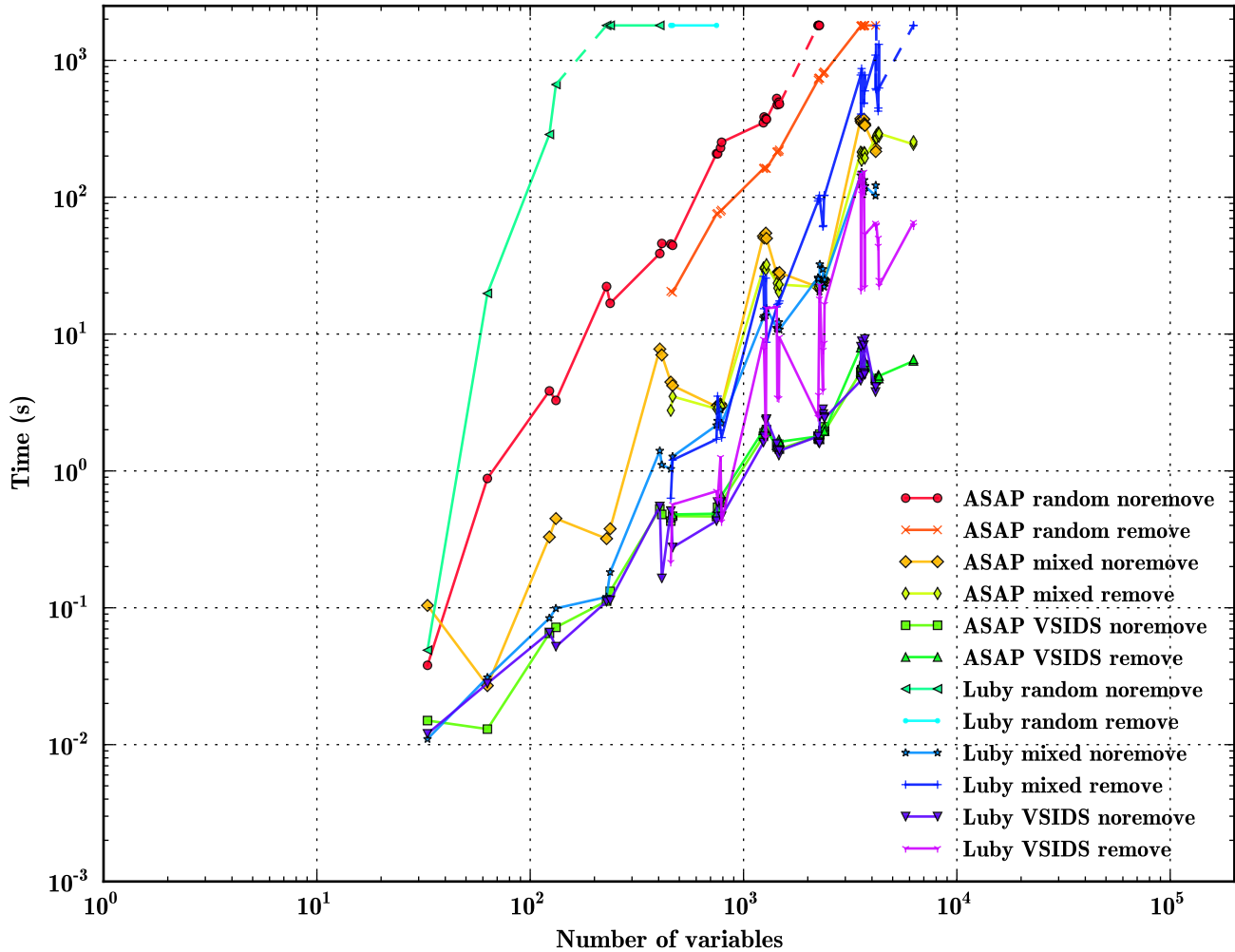


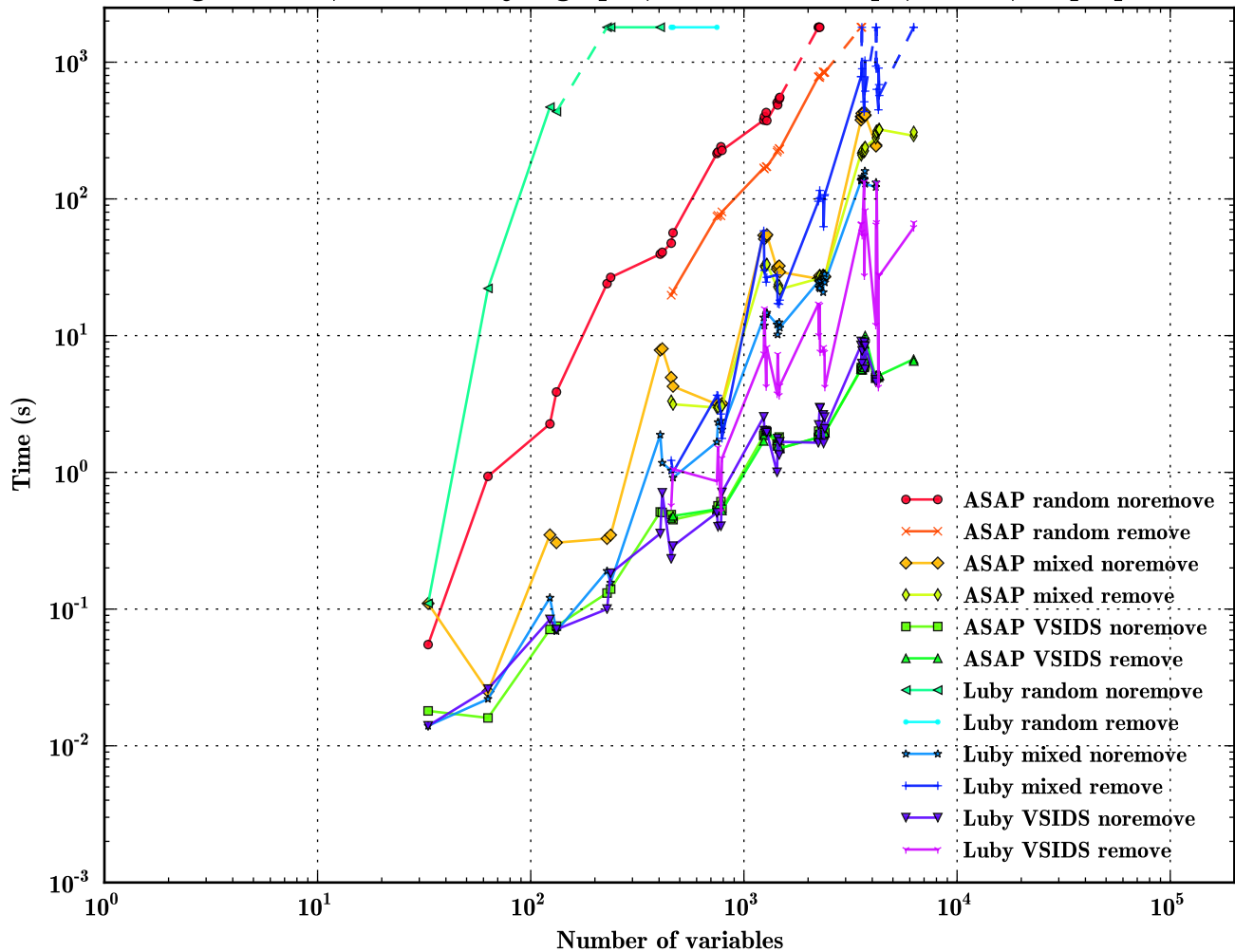
**CPU time**  
**loglog scale**

**Pebbling formulas with  
substitution neq(not all equal)  
of arity 3**

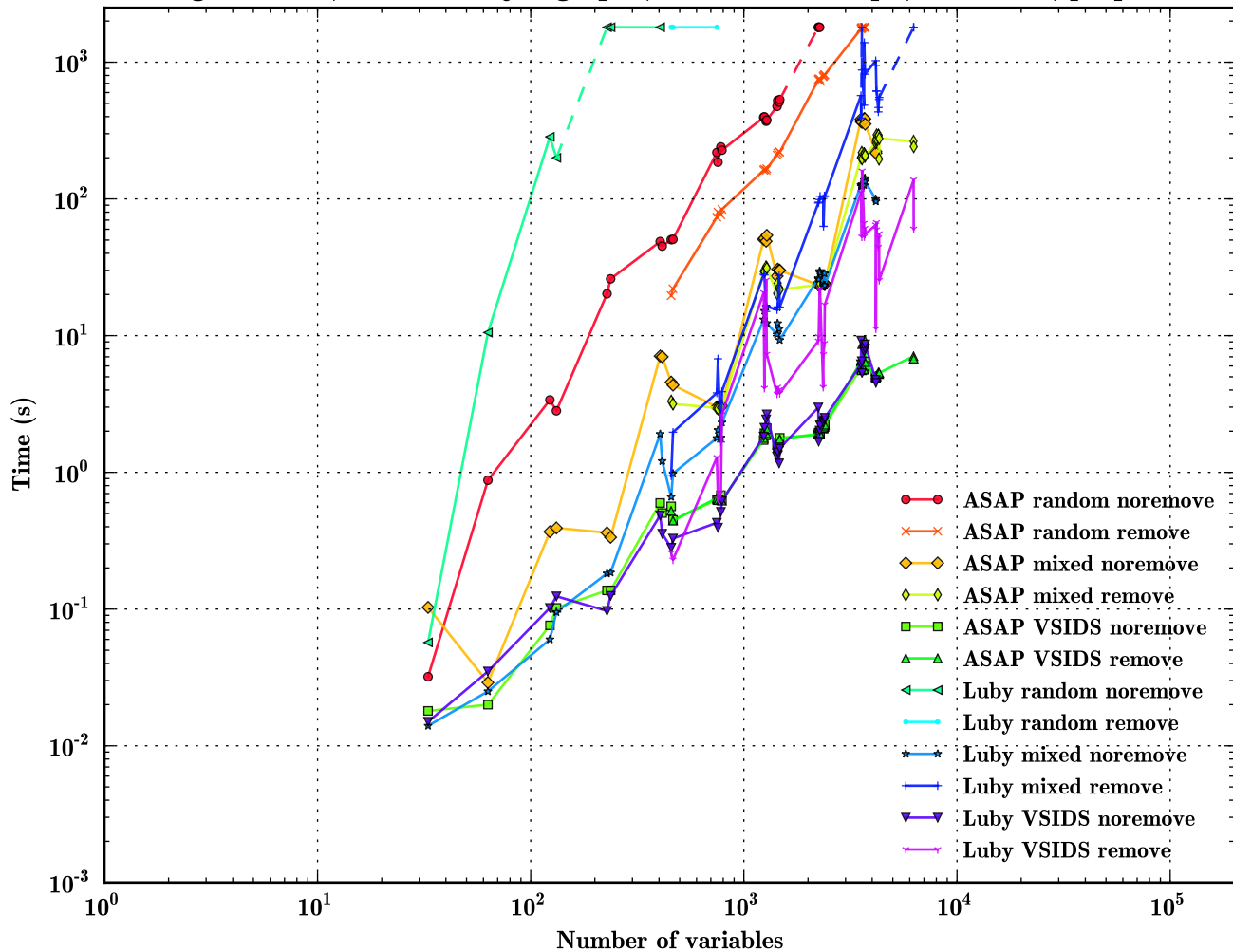
# Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, no preprocessing



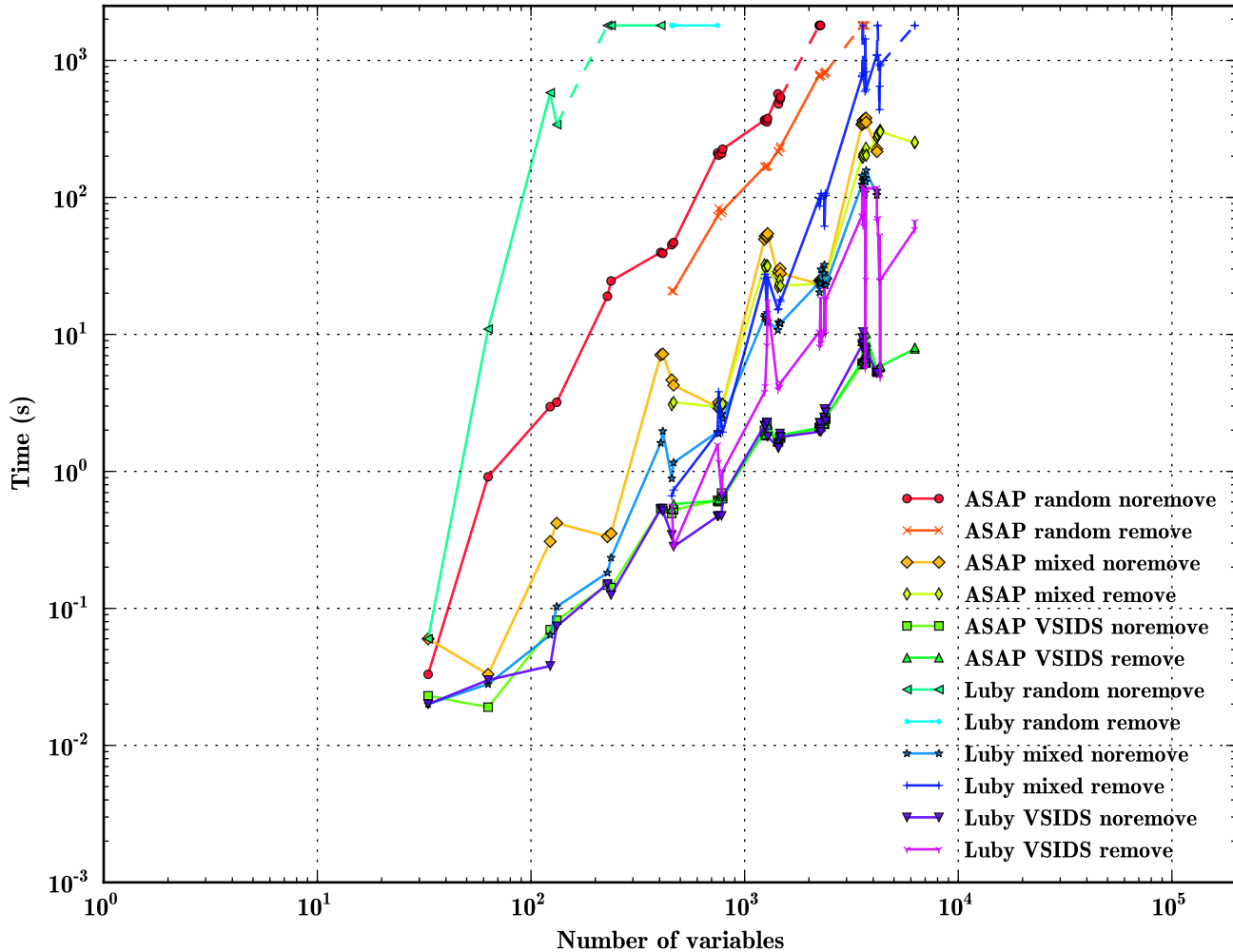
Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, no preprocessing



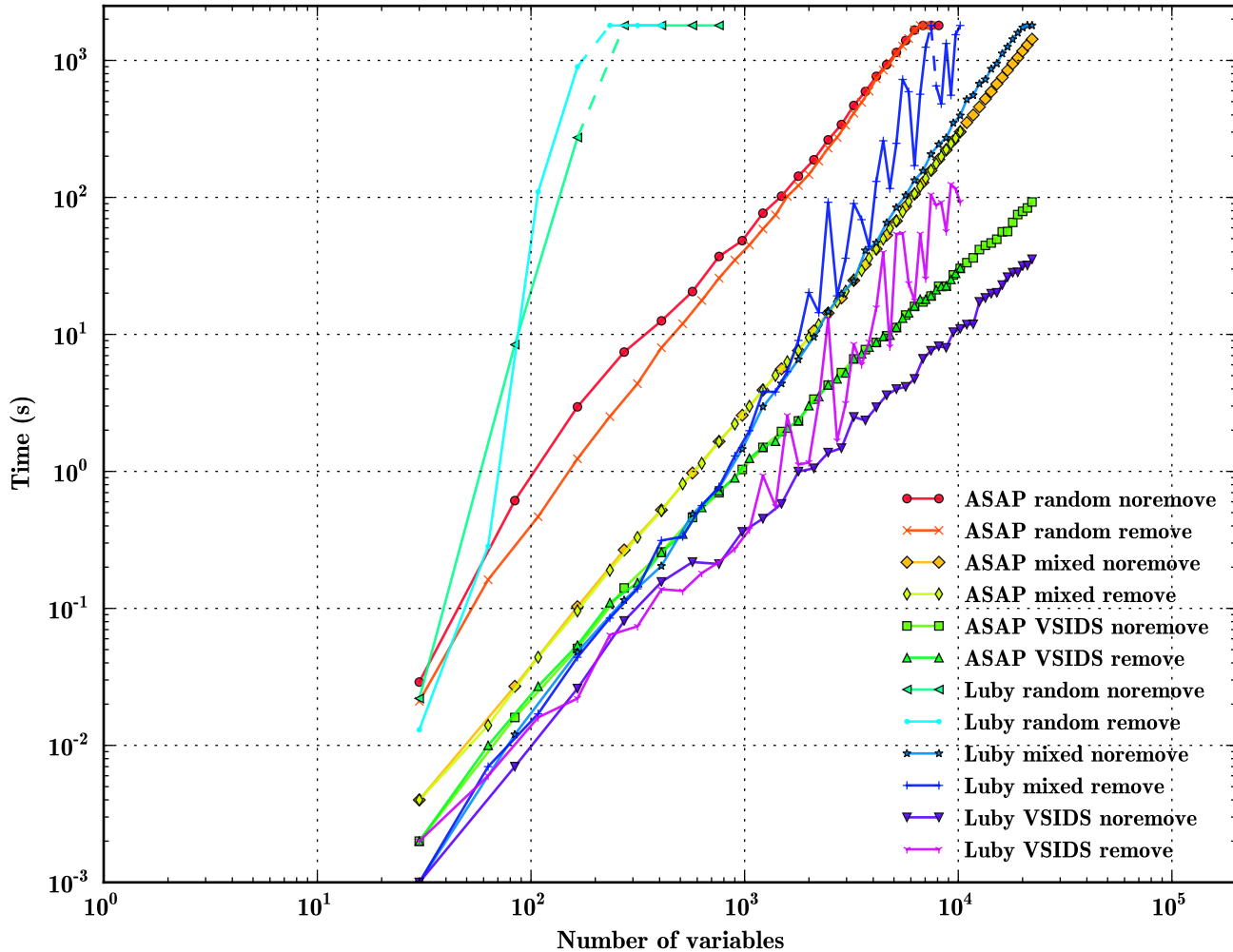
Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, preprocessing



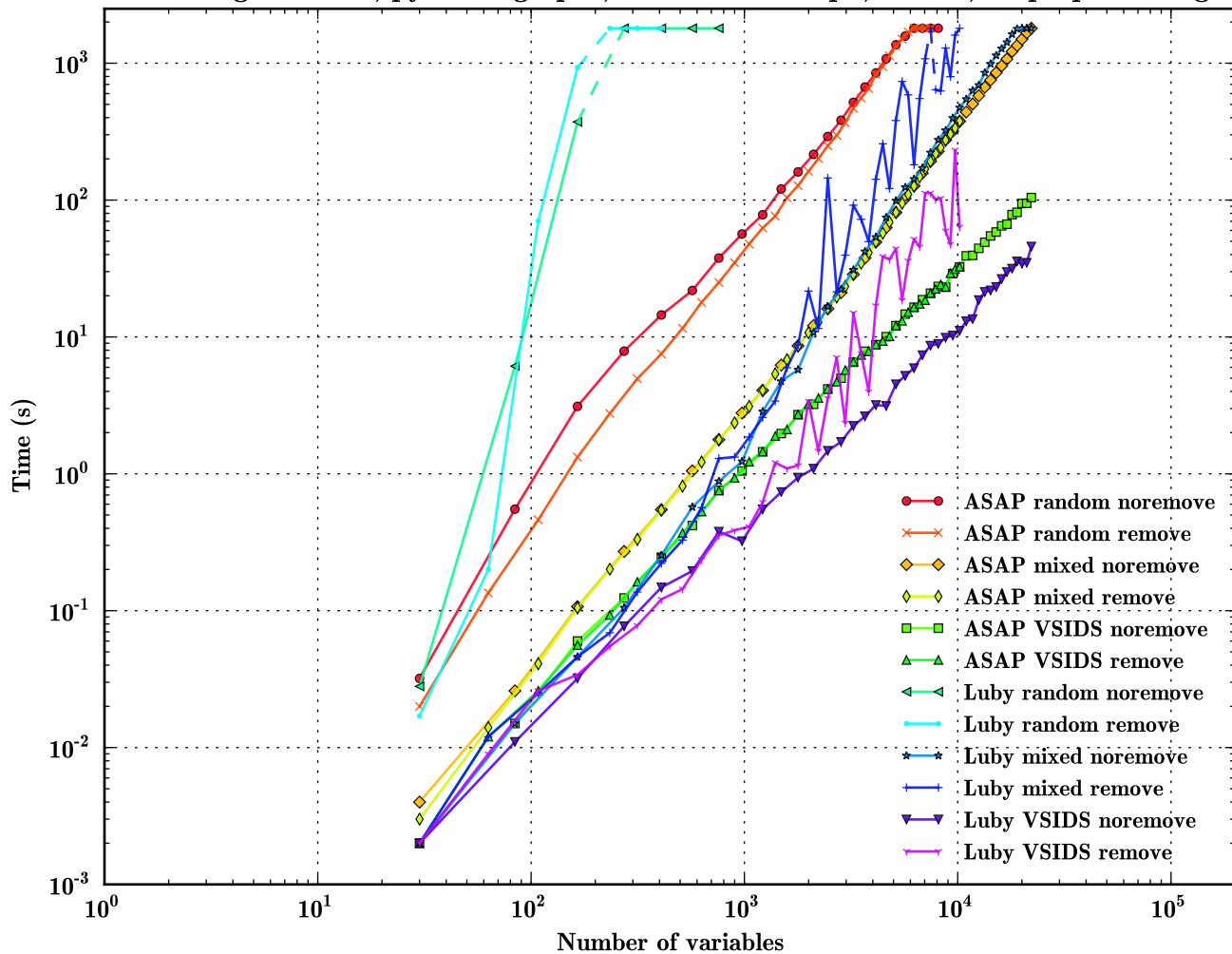
# Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, preprocessing



Pebbling formulas, pyramid graphs, substitution neq 3, no shuffle, no preprocessing



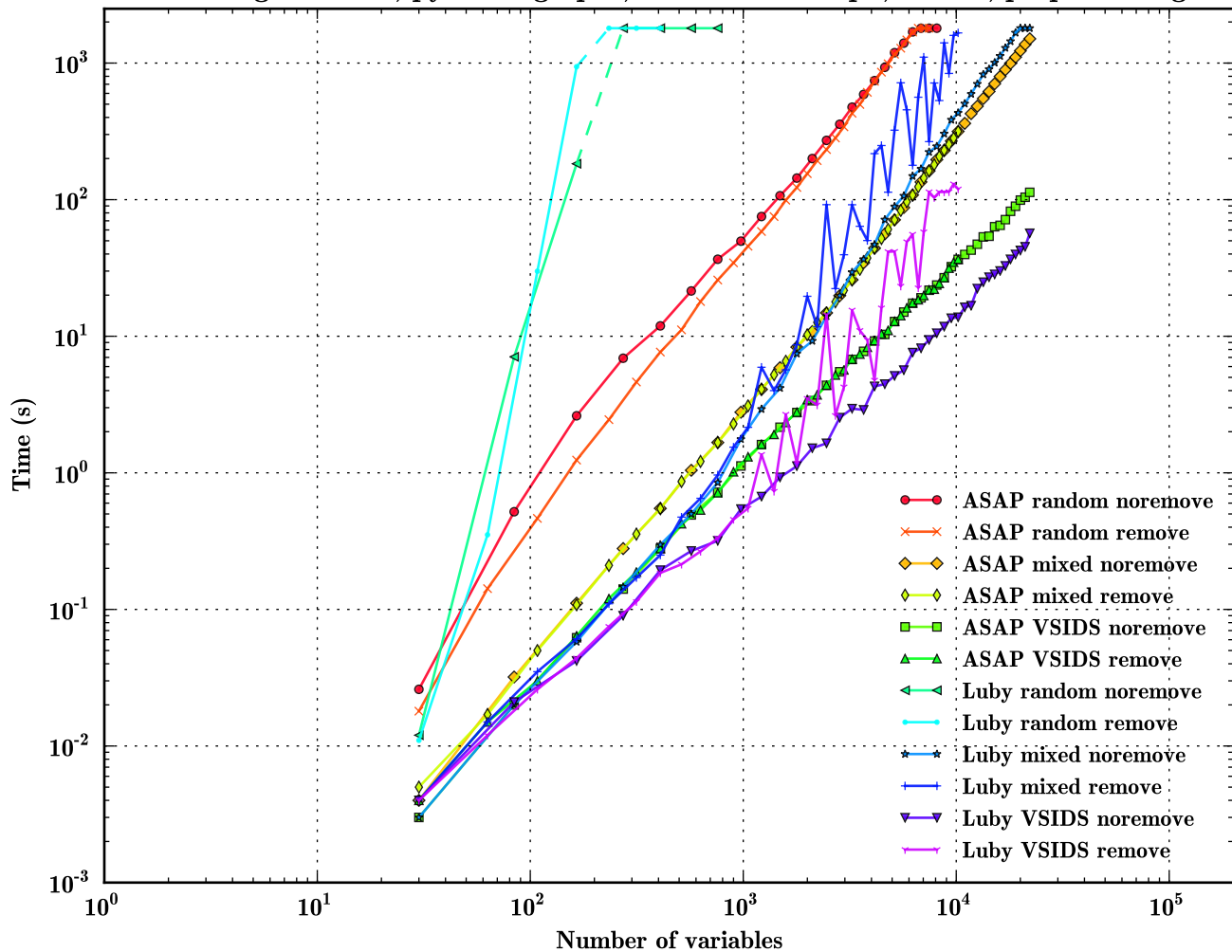
Pebbling formulas, pyramid graphs, substitution neq 3, shuffle, no preprocessing



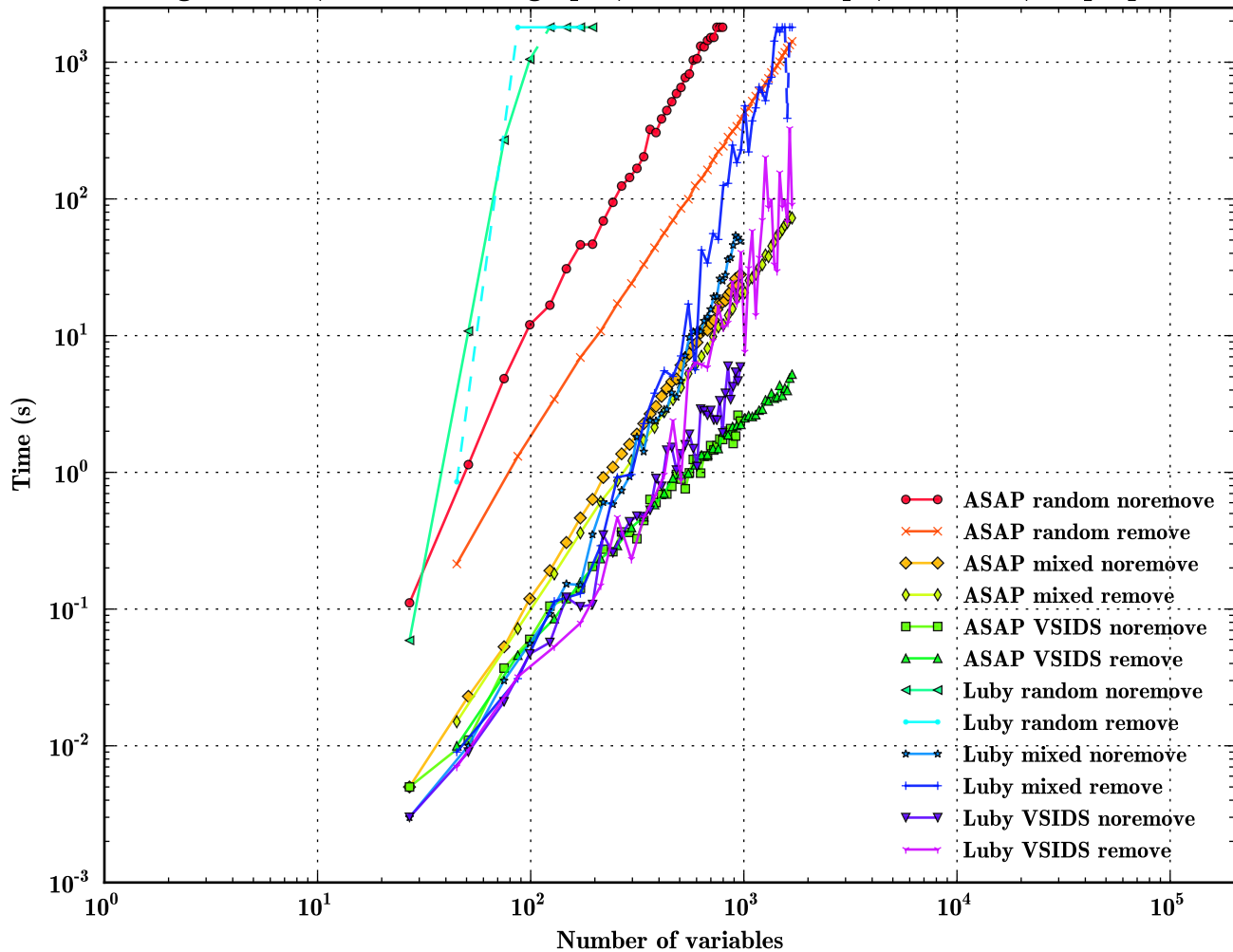




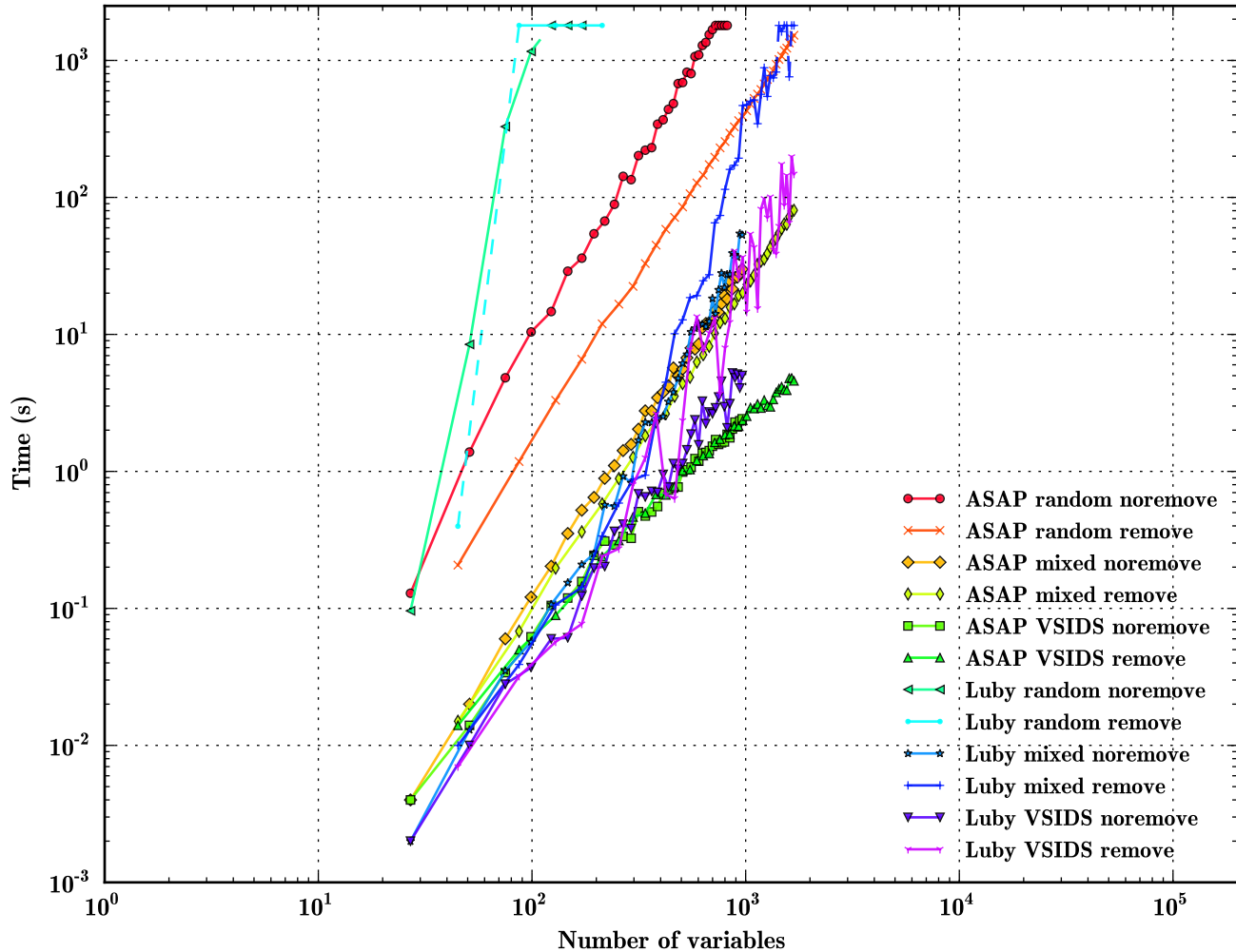
Pebbling formulas, pyramid graphs, substitution neq 3, shuffle, preprocessing



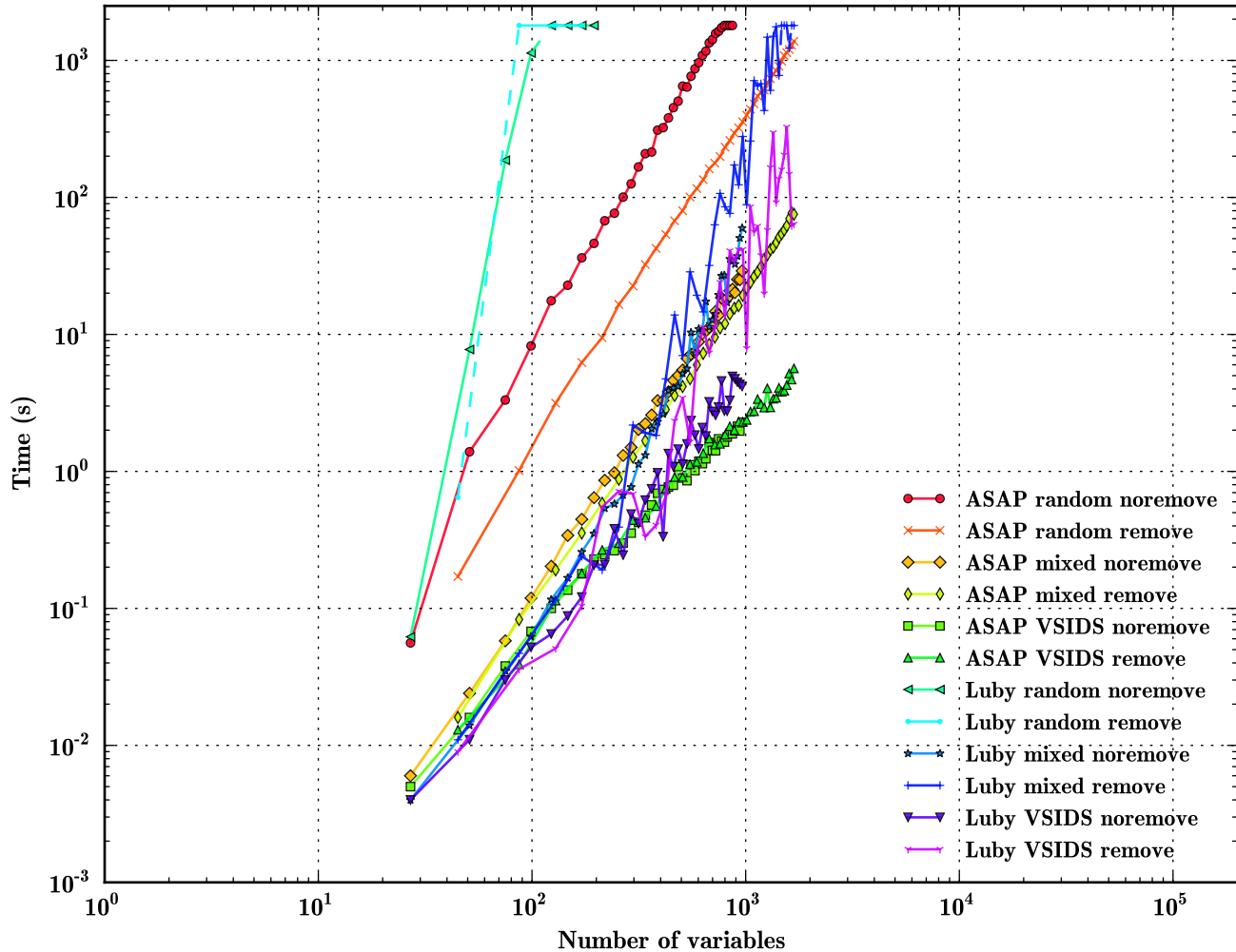
Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, no preprocessing



Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, no preprocessing

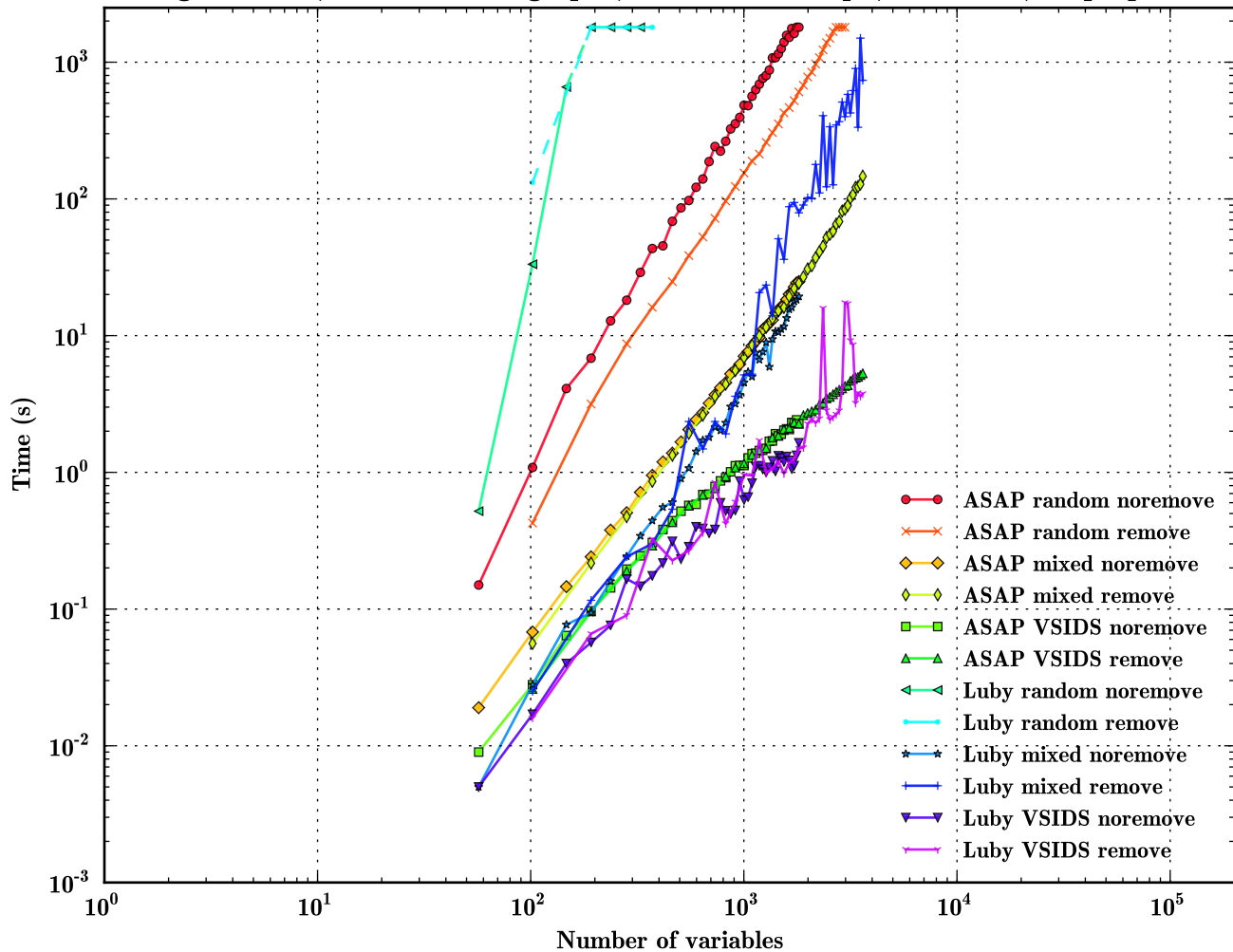


Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, preprocessing

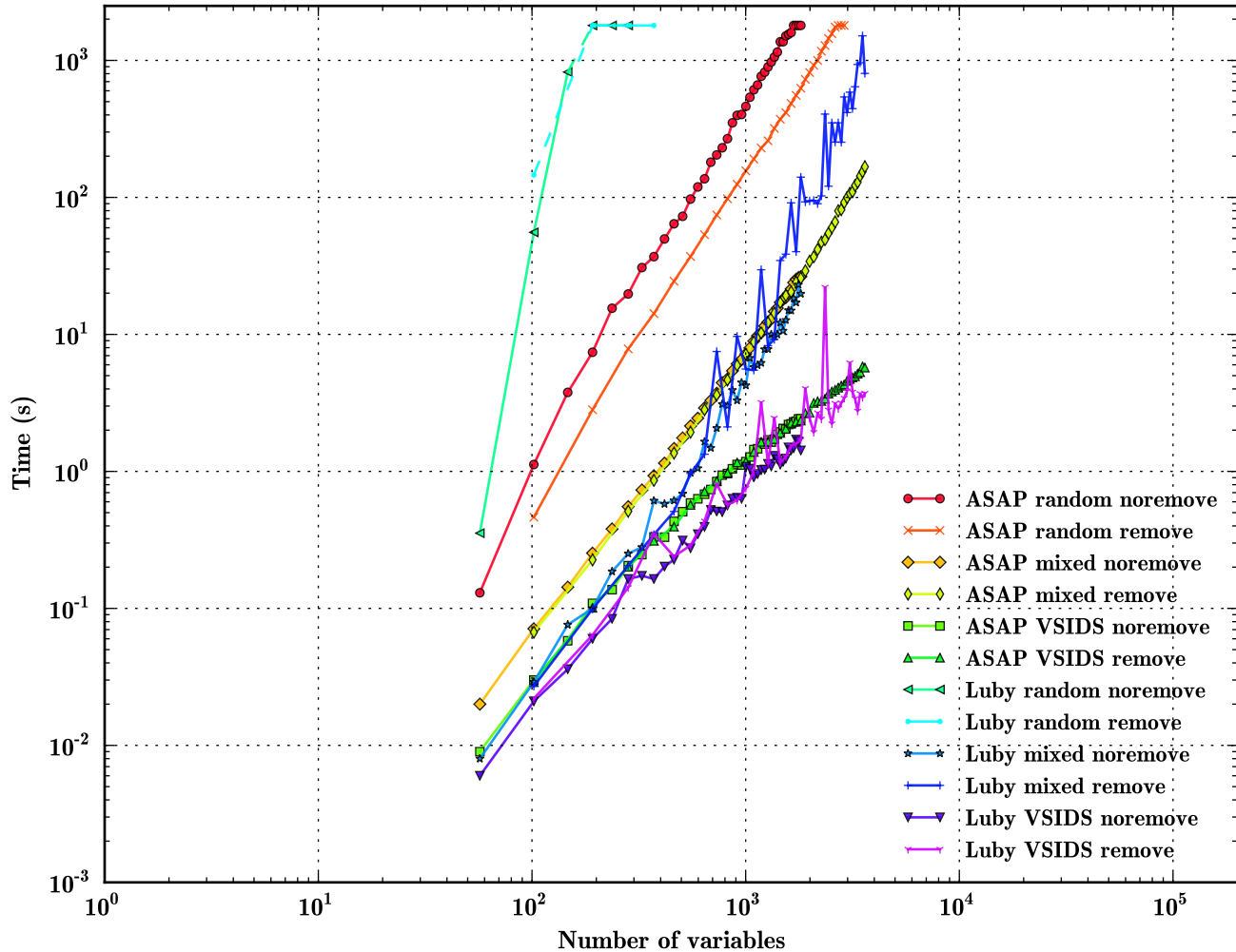




Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, no preprocessing

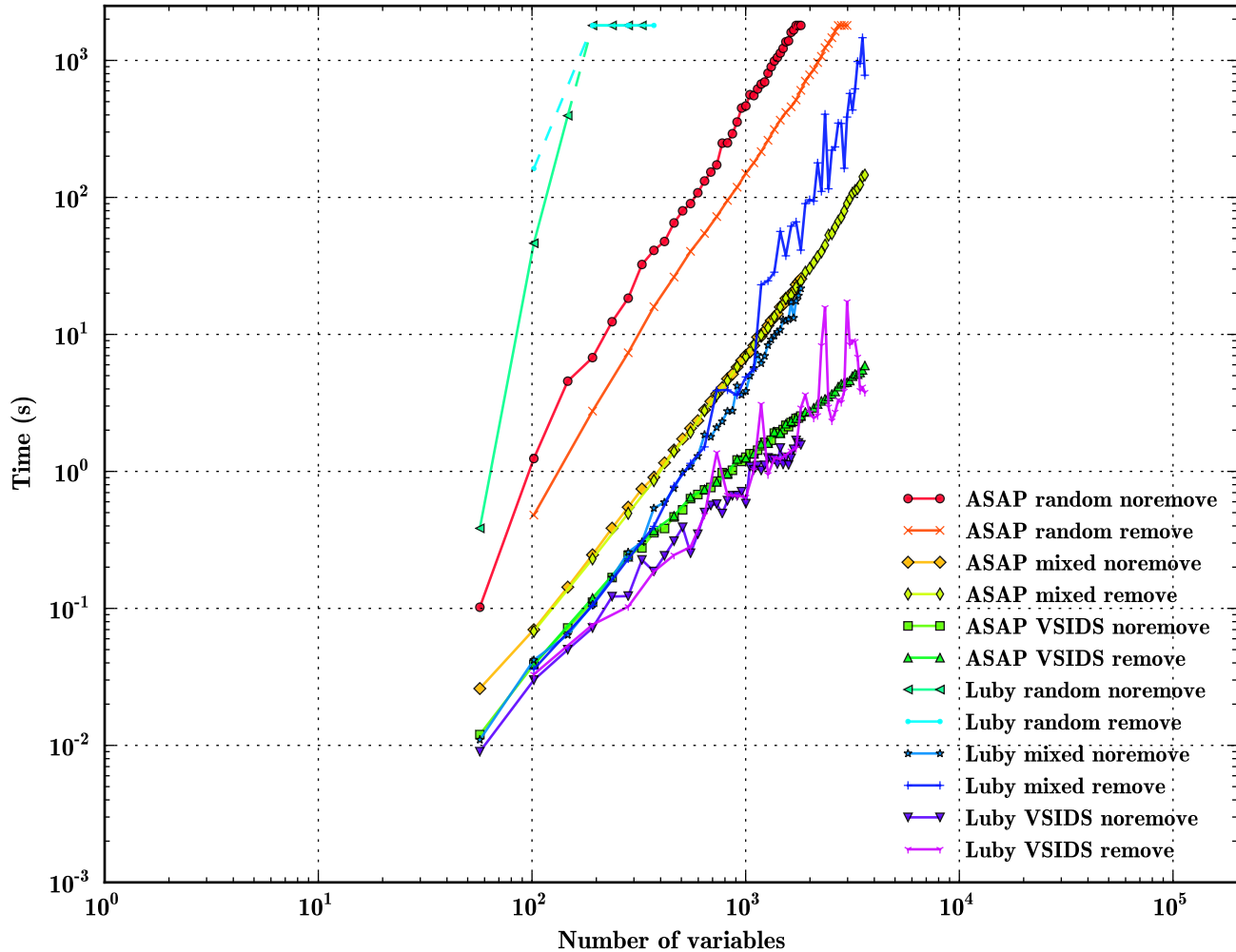


Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, no preprocessing

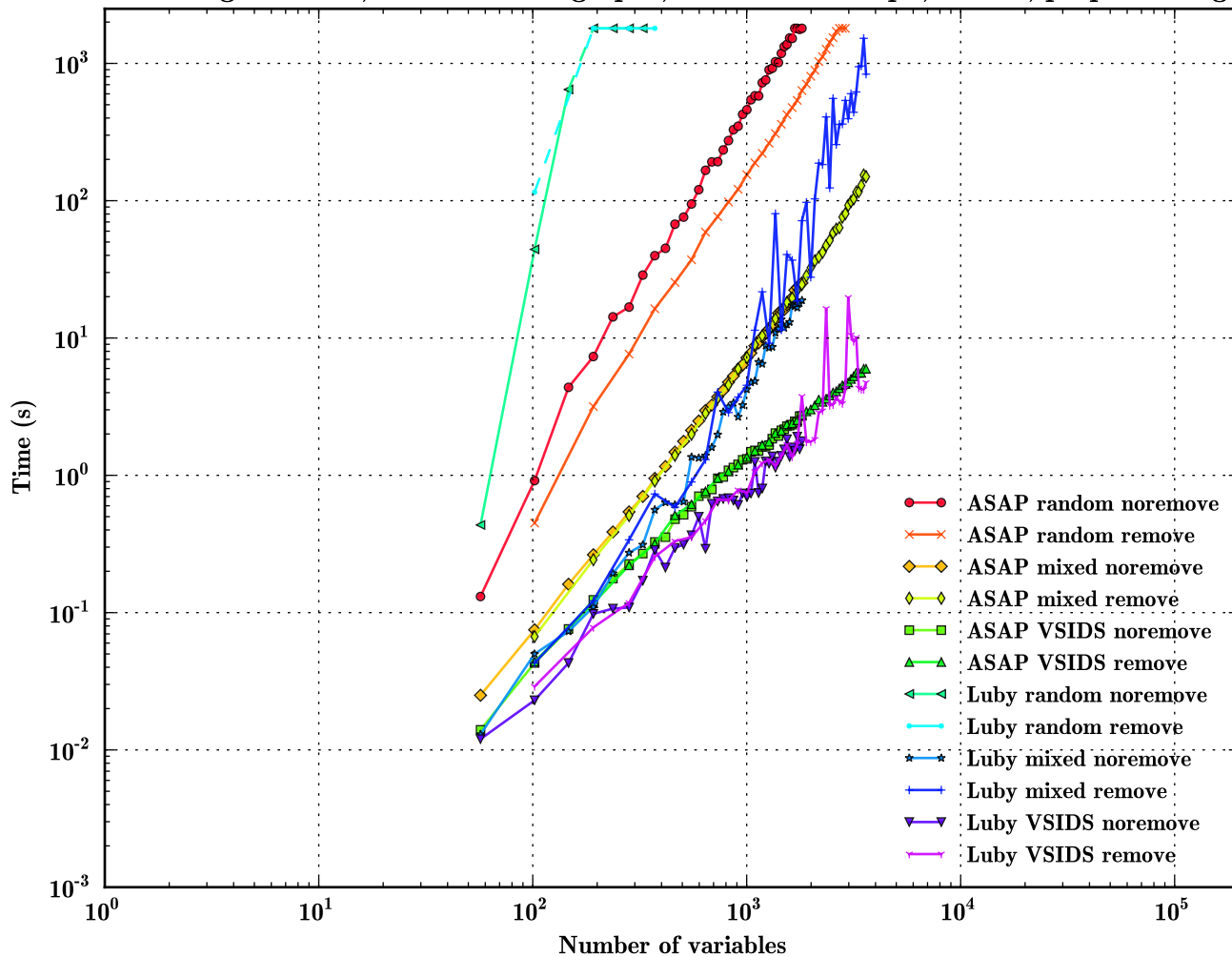




Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, preprocessing



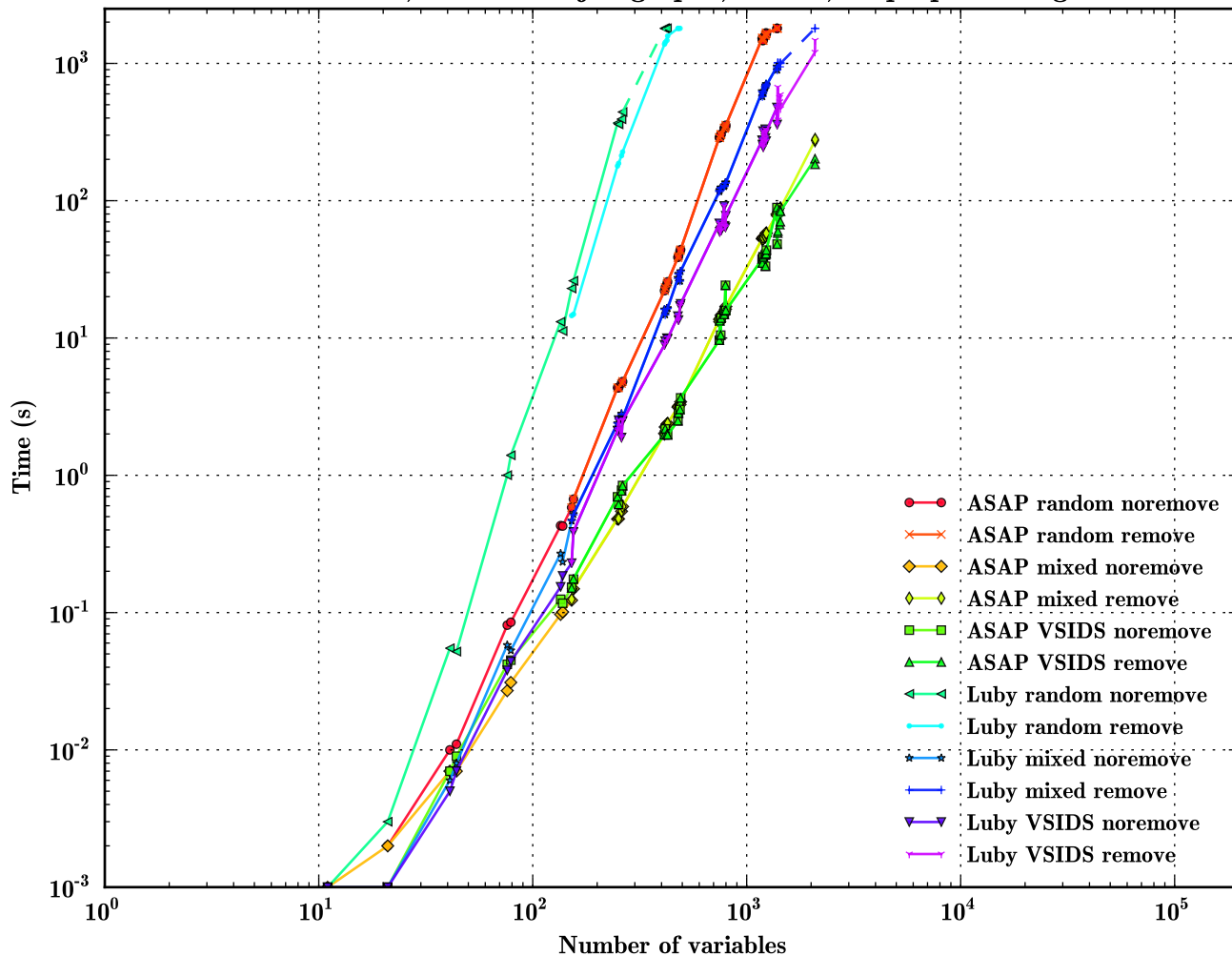
Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, preprocessing



# **Cartesian products of vanilla pebbling formulas**

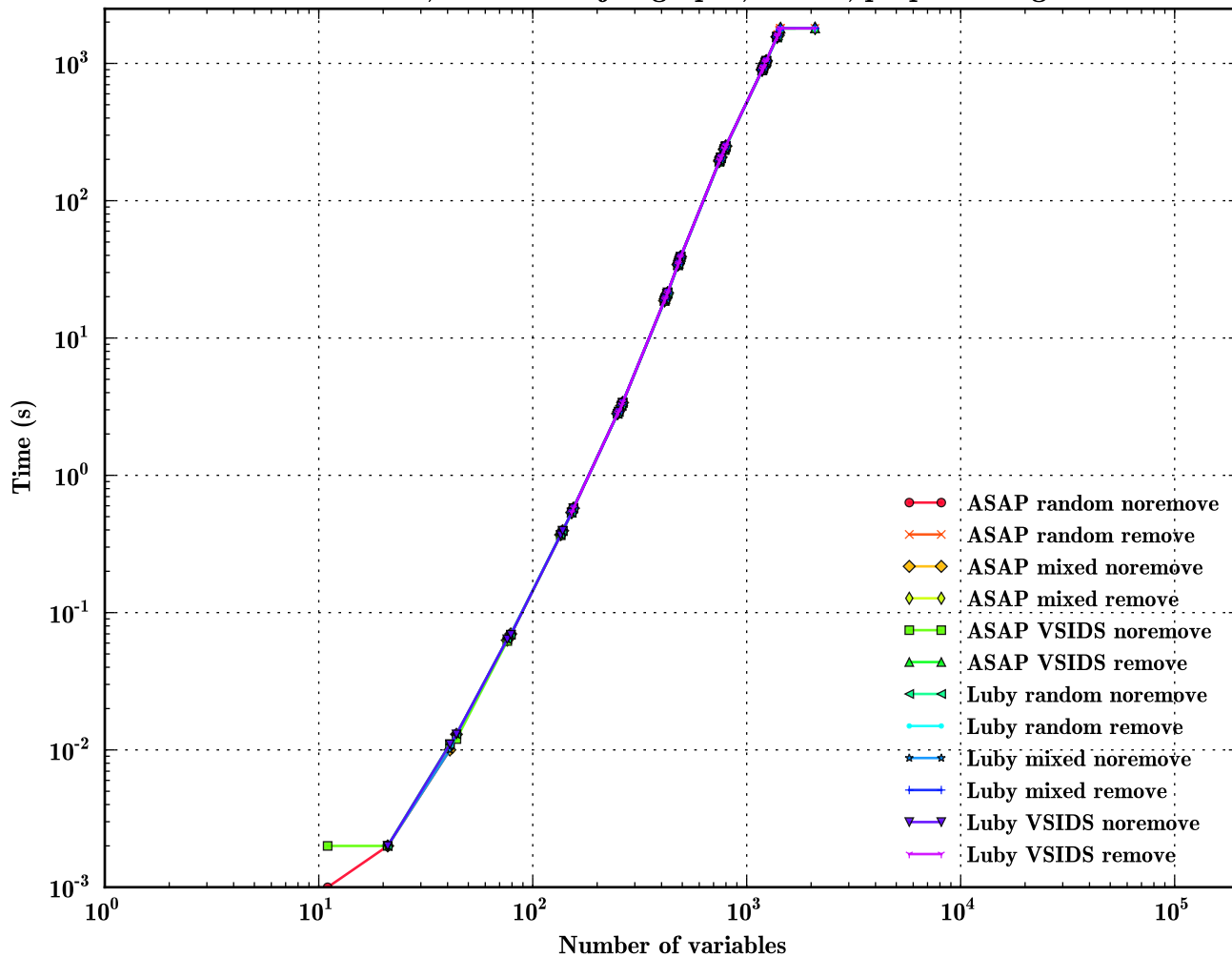


Cartesian, Gilbert-Tarjan graphs, shuffle, no preprocessing





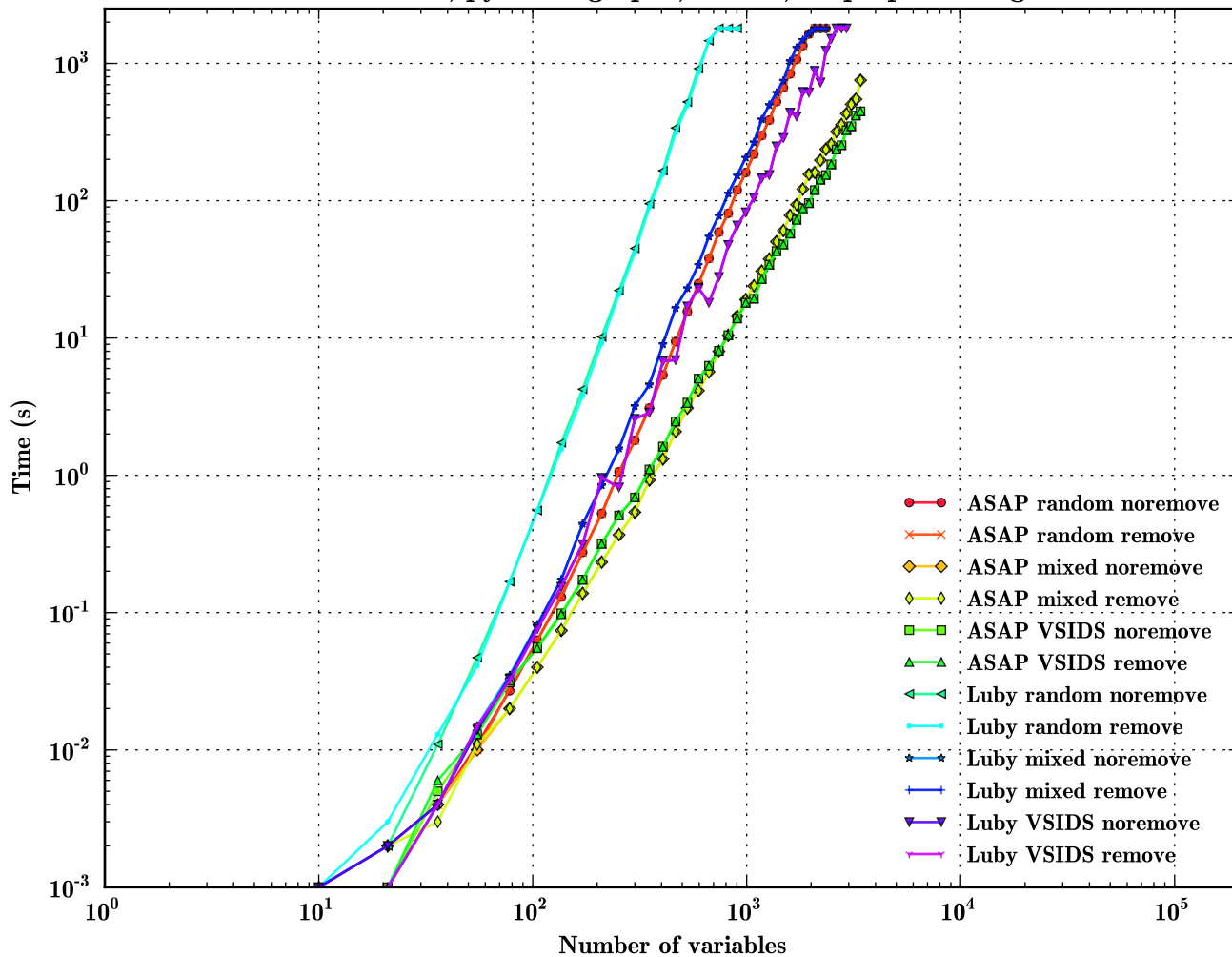
Cartesian, Gilbert-Tarjan graphs, shuffle, preprocessing





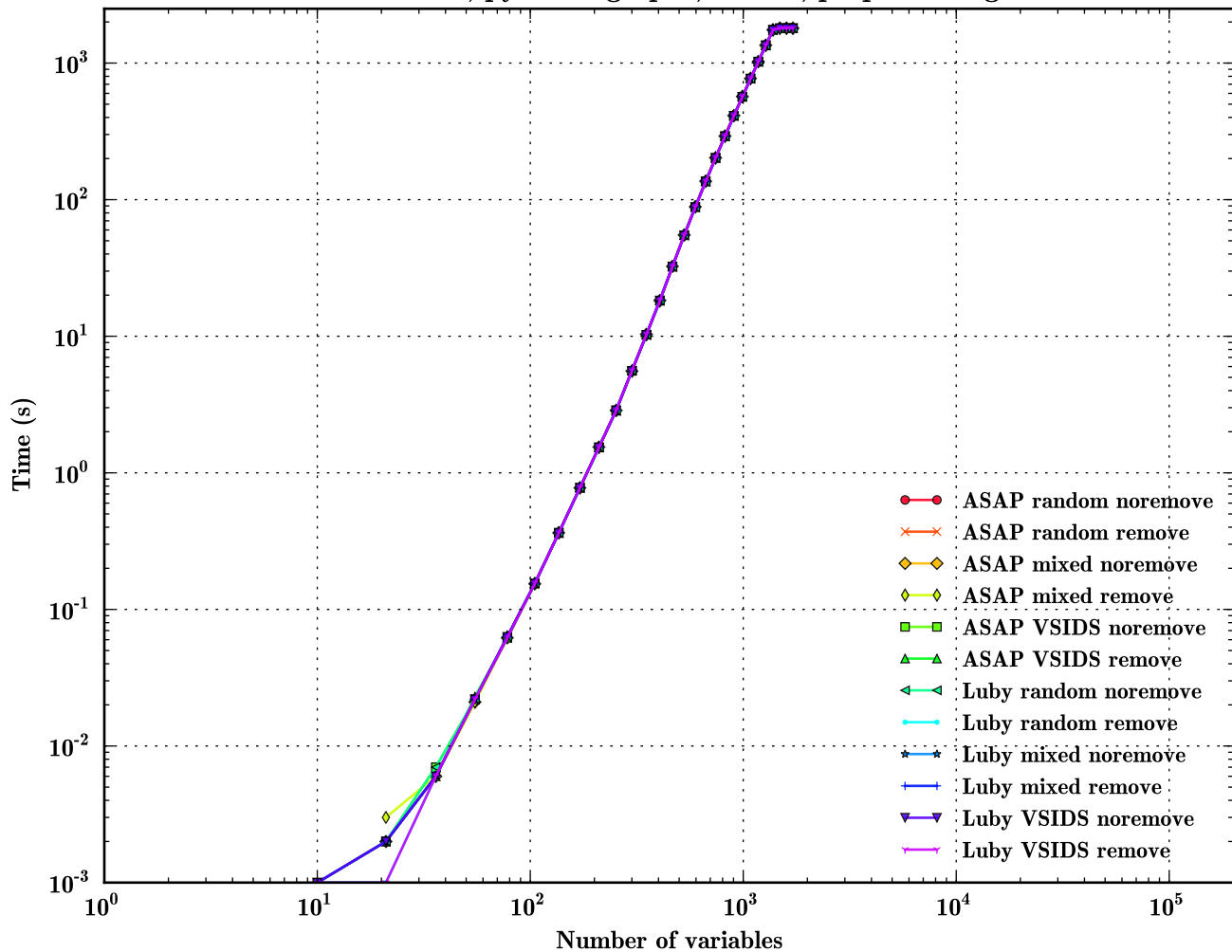


Cartesian, pyramid graphs, shuffle, no preprocessing



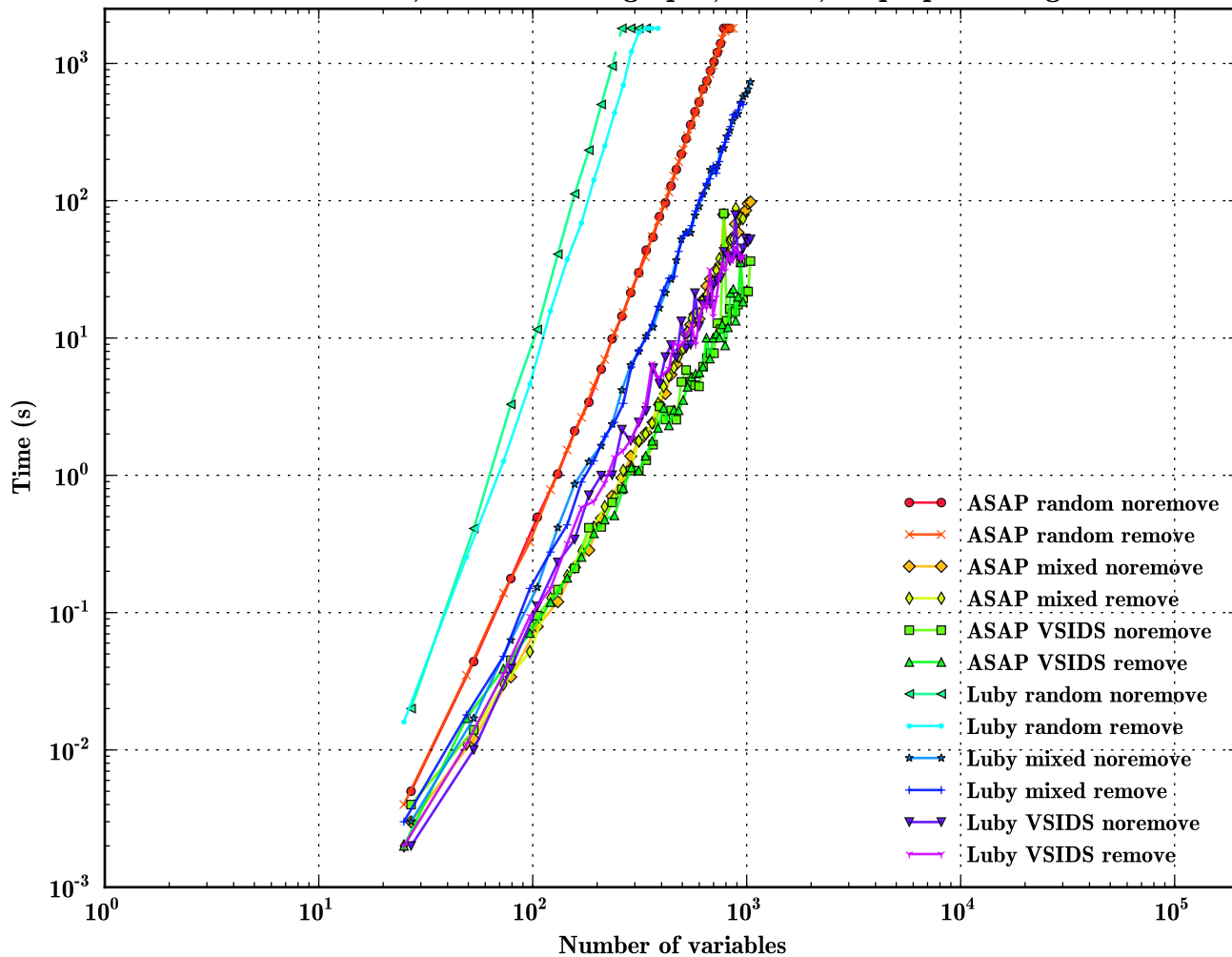


# Cartesian, pyramid graphs, shuffle, preprocessing

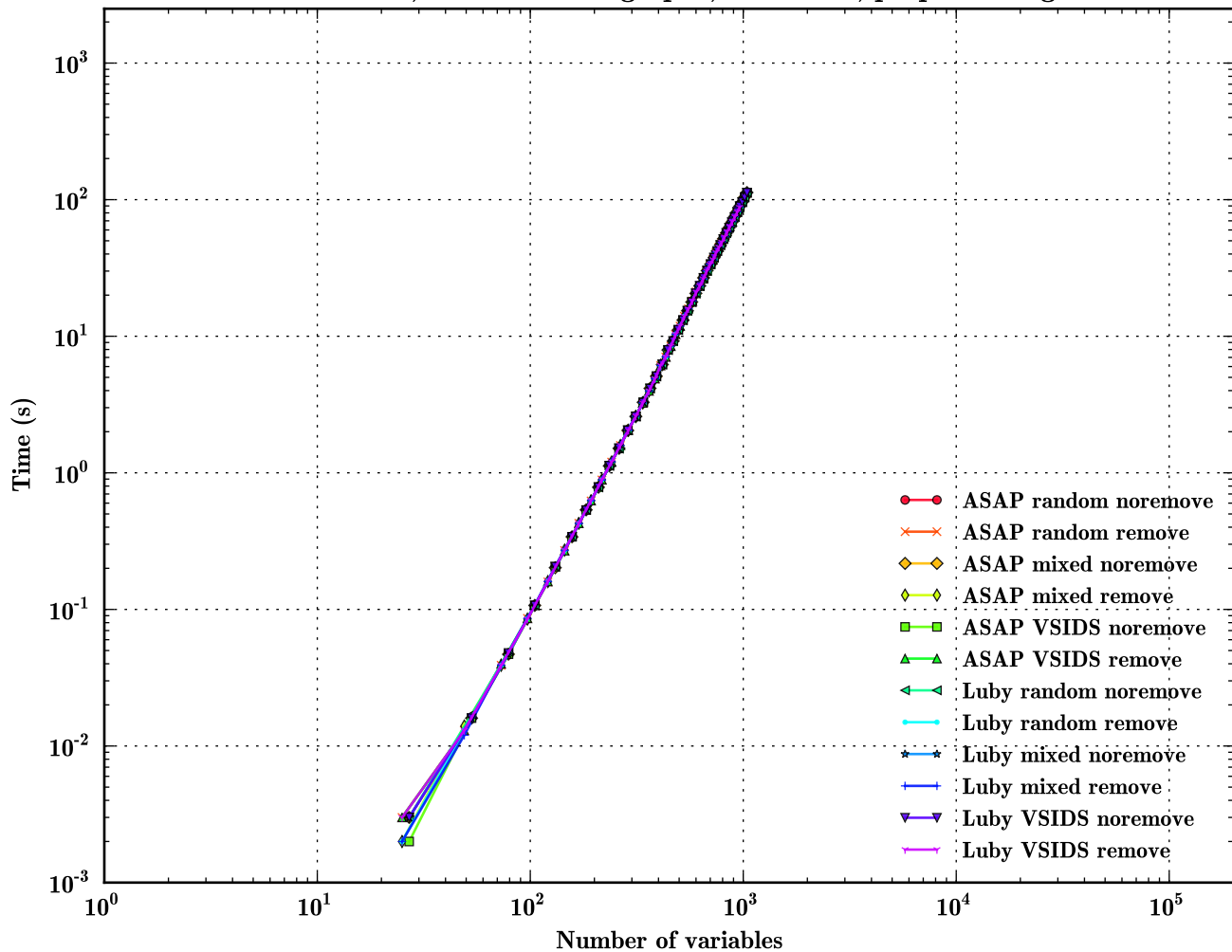




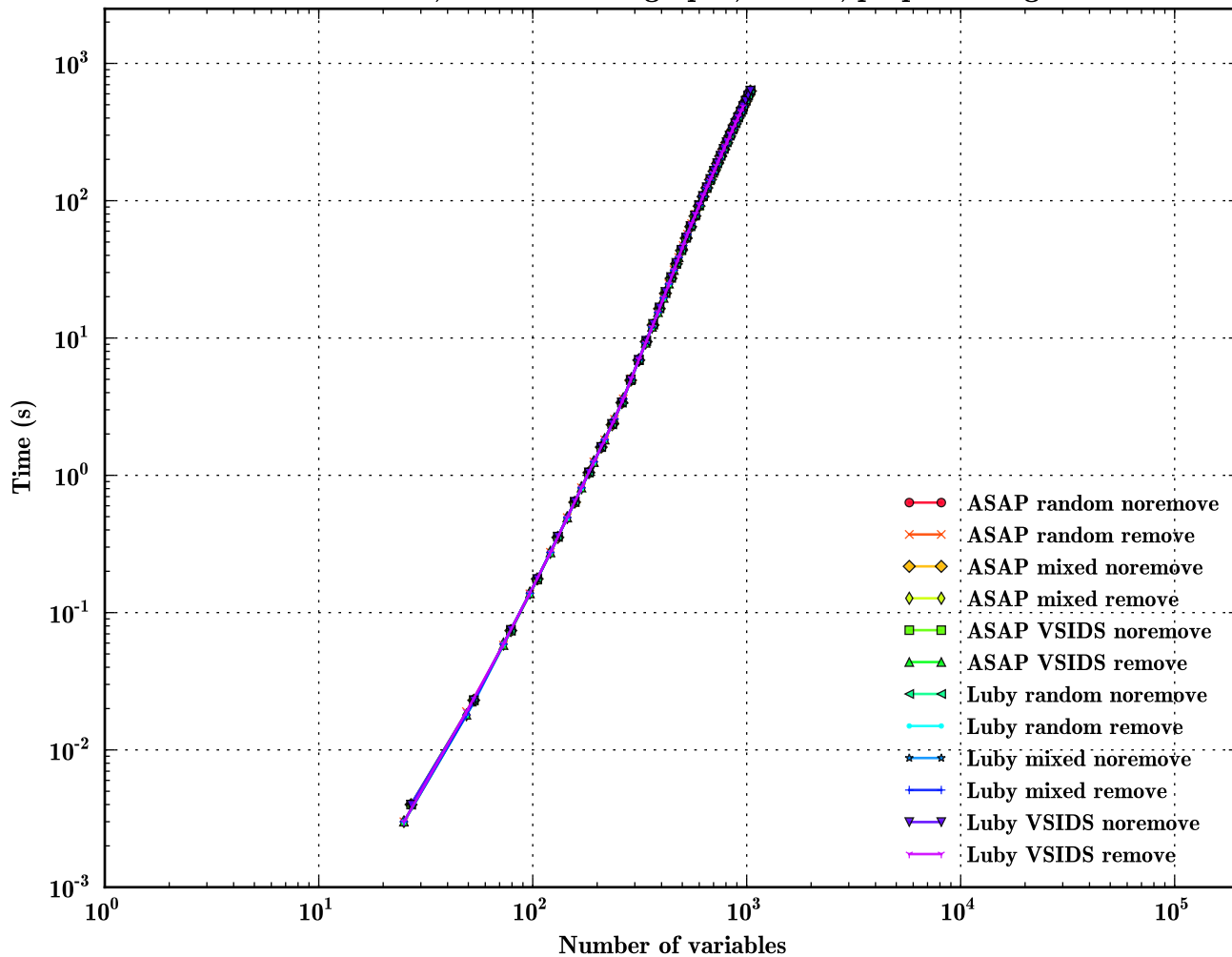
Cartesian, width 2 chain graphs, shuffle, no preprocessing



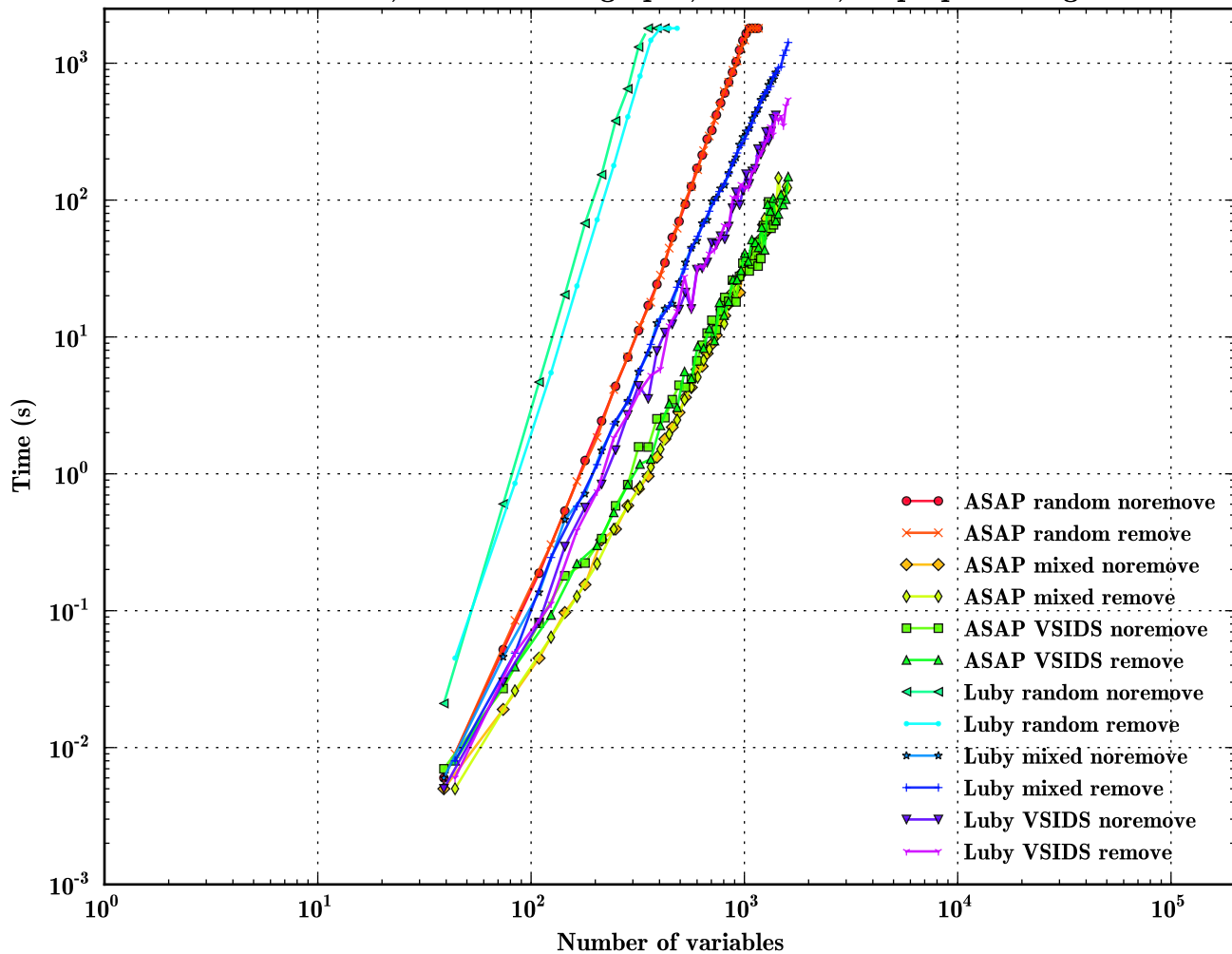
Cartesian, width 2 chain graphs, no shuffle, preprocessing



Cartesian, width 2 chain graphs, shuffle, preprocessing

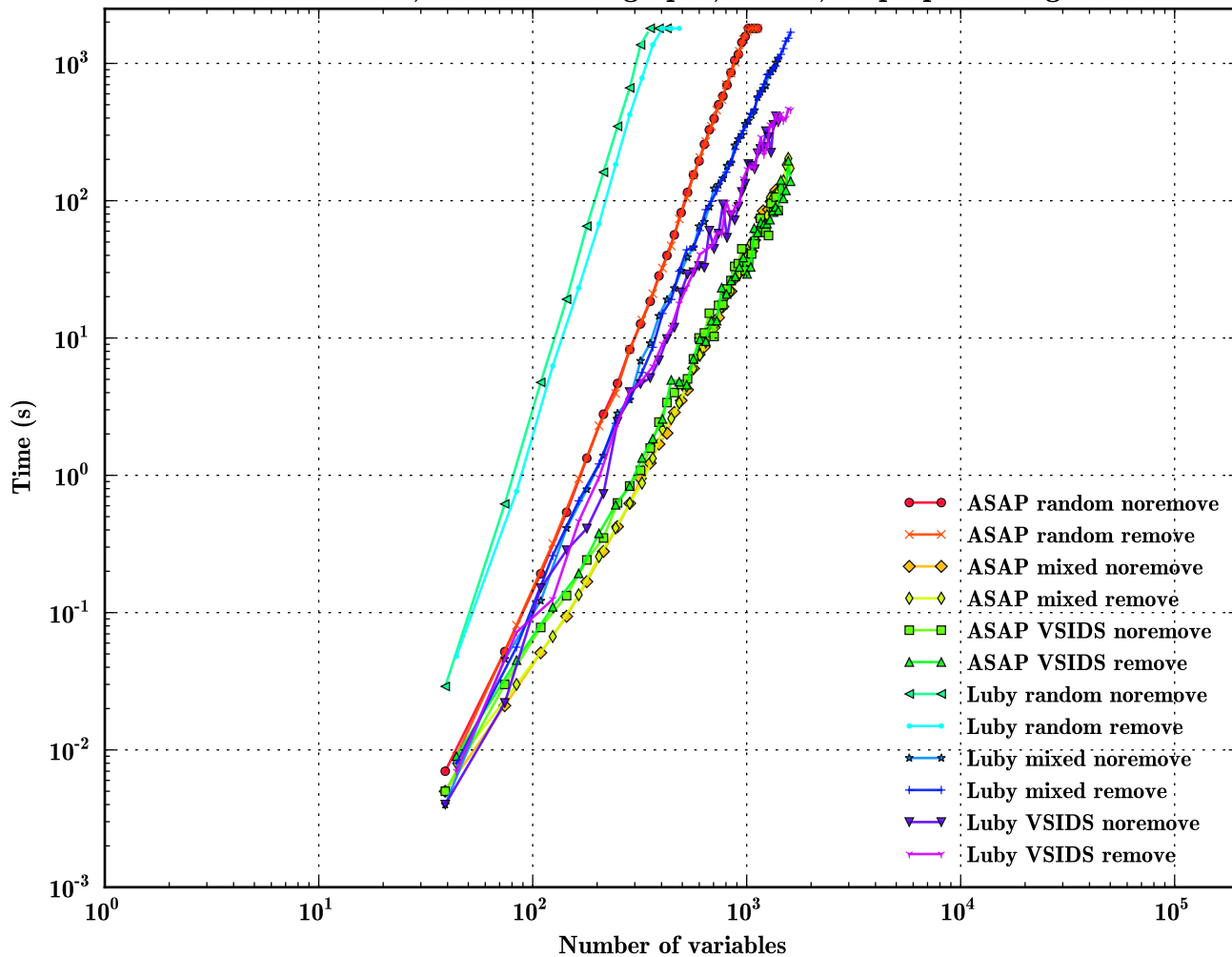


Cartesian, width 5 chain graphs, no shuffle, no preprocessing

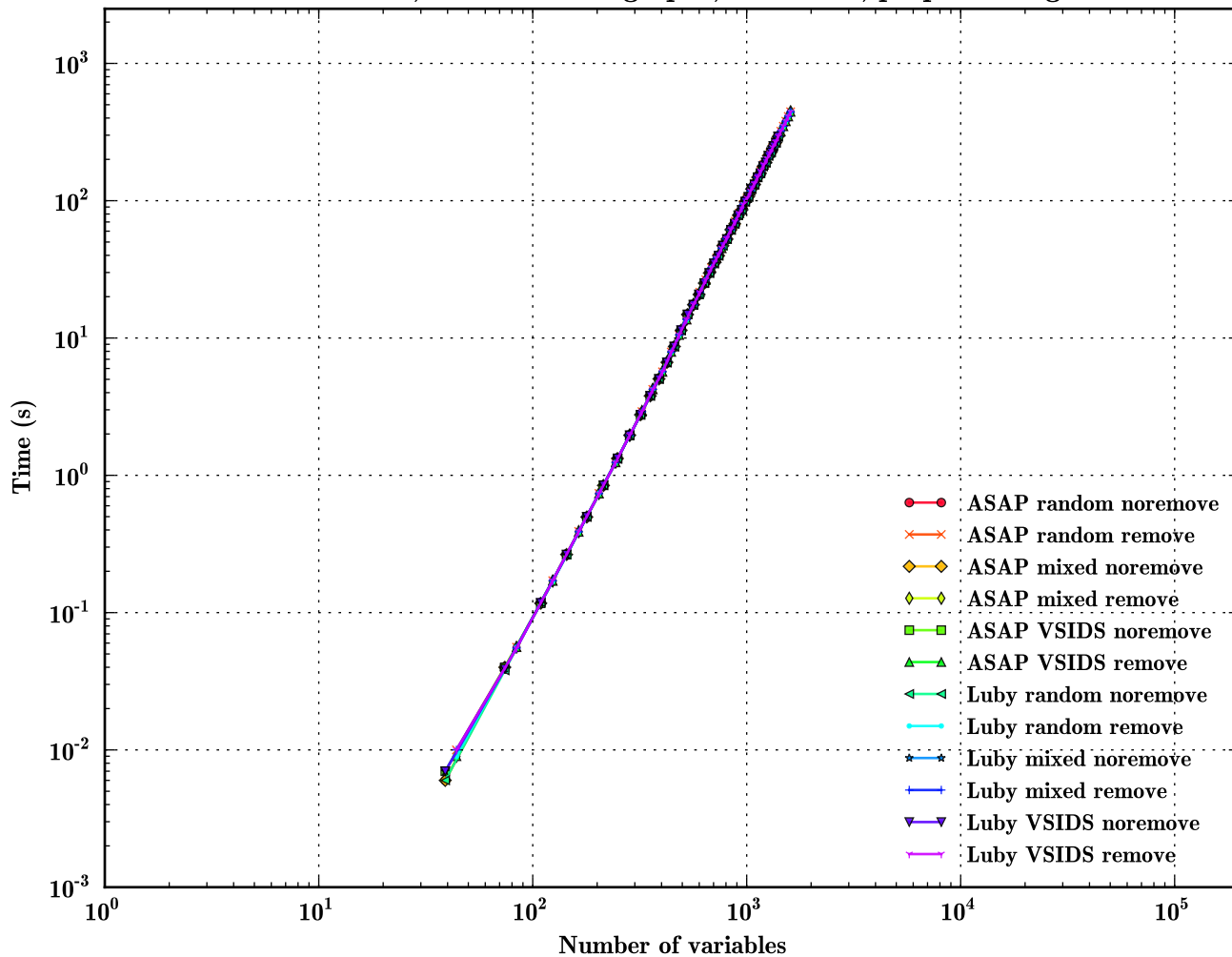




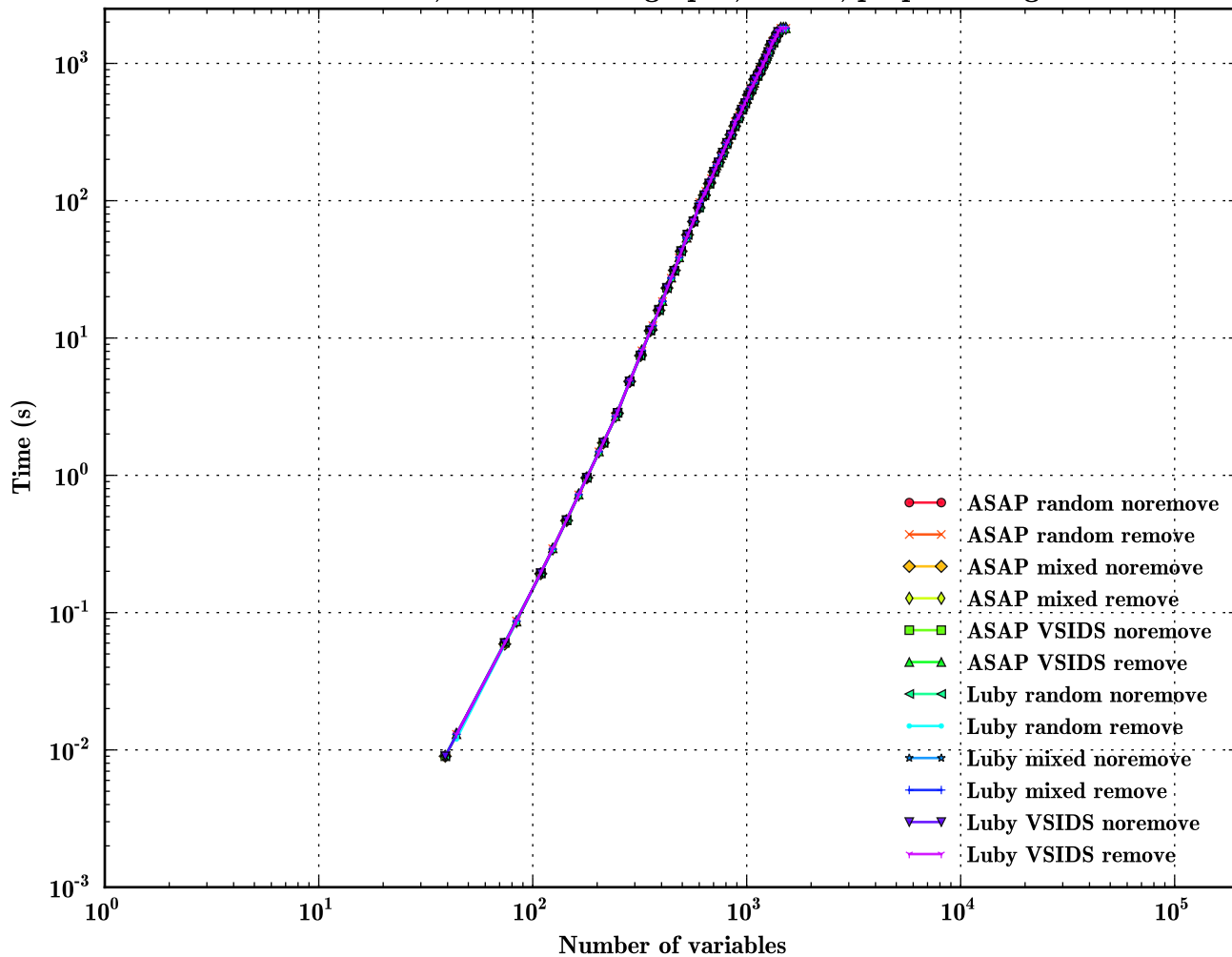
Cartesian, width 5 chain graphs, shuffle, no preprocessing



Cartesian, width 5 chain graphs, no shuffle, preprocessing

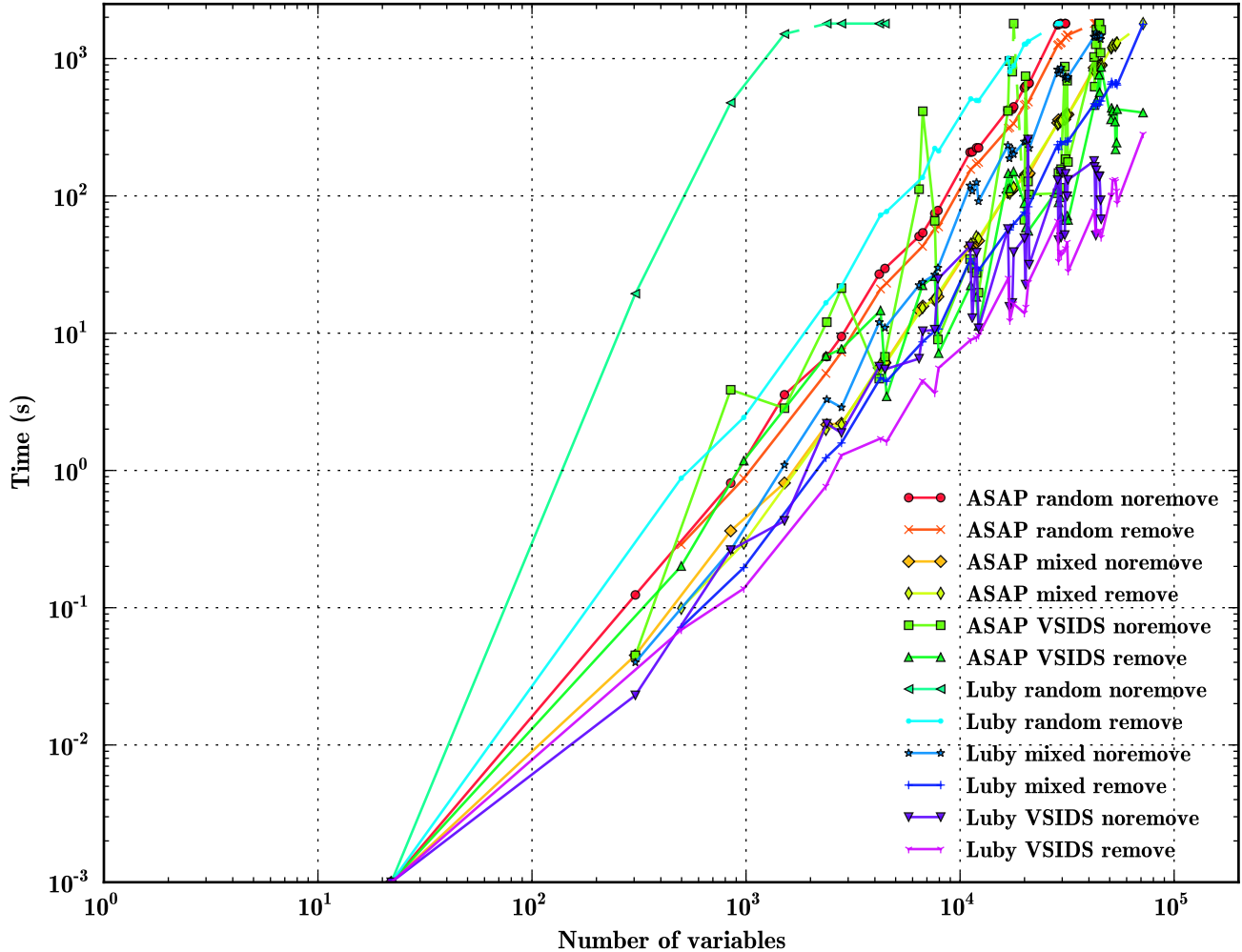


Cartesian, width 5 chain graphs, shuffle, preprocessing



# **Pebbling formulas with substitution or of arity 2**

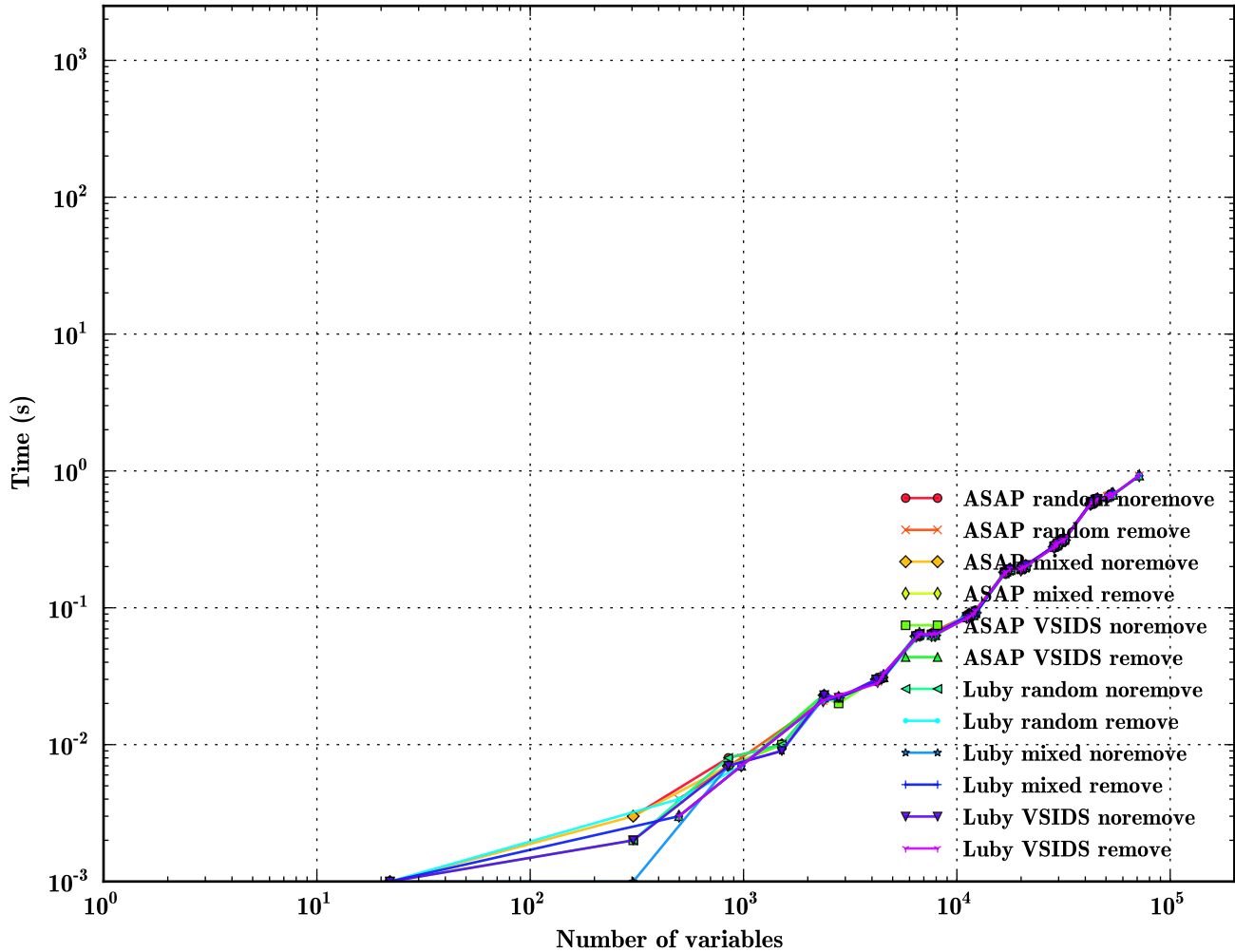
Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, no shuffle, no preprocessing





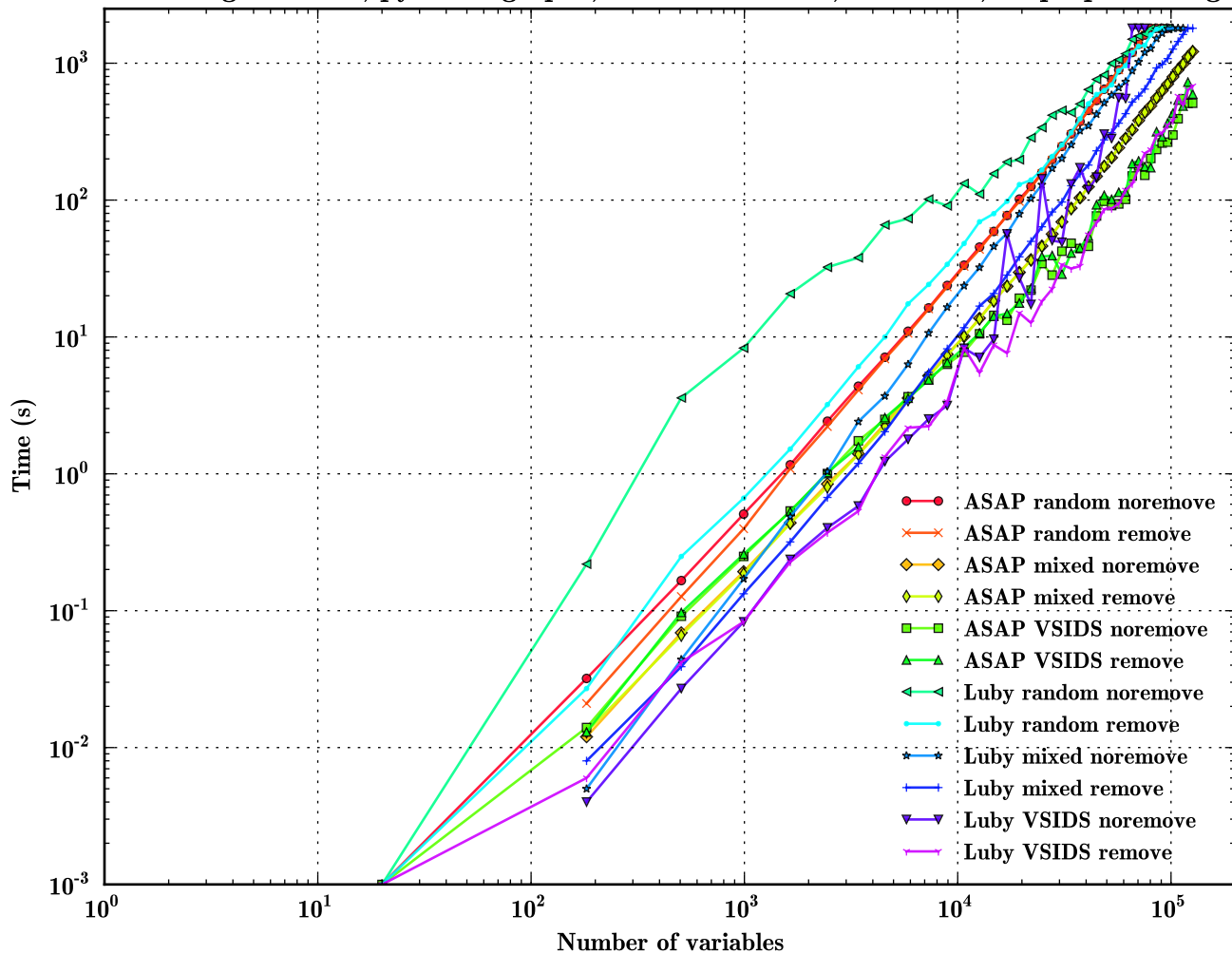


# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, shuffle, preprocessing



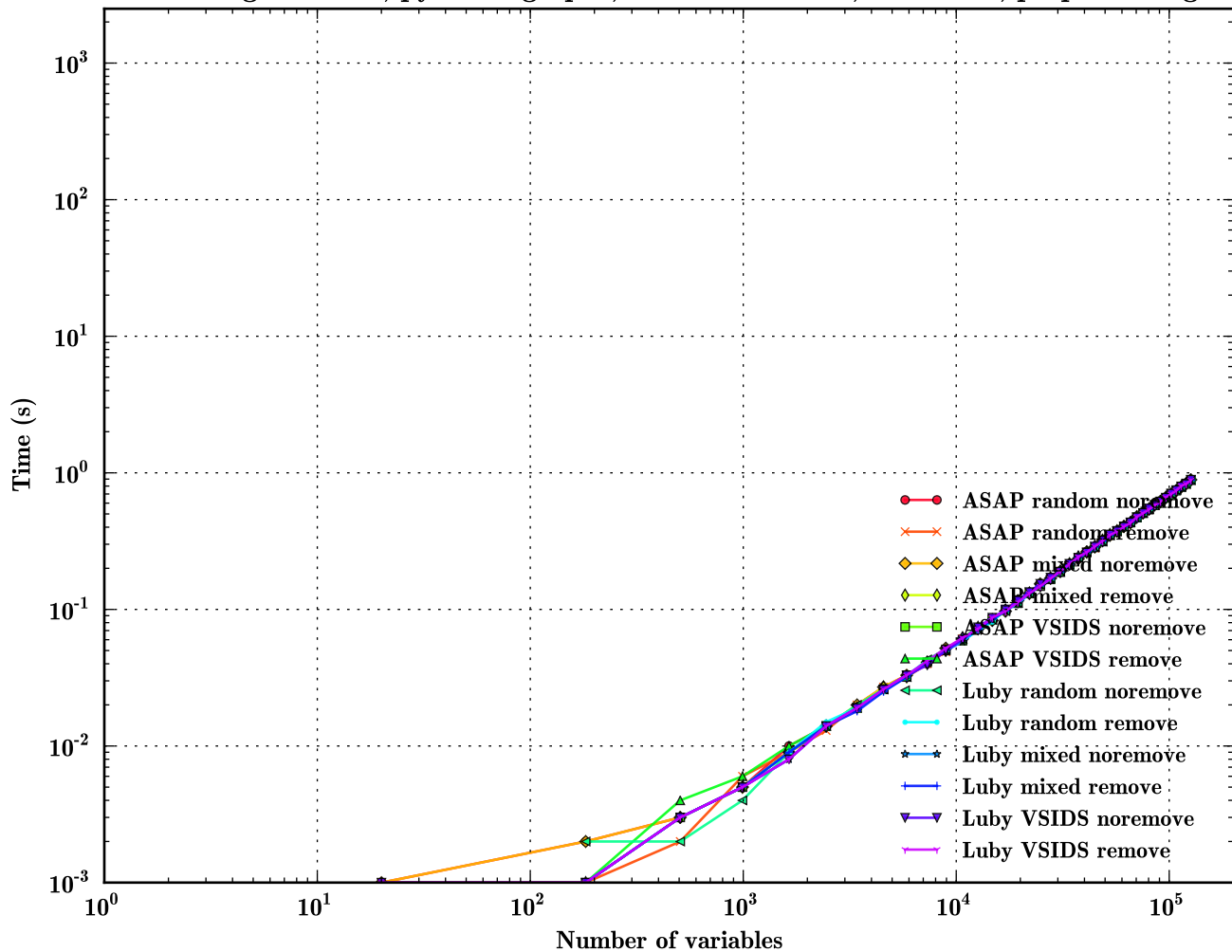


Pebbling formulas, pyramid graphs, substitution or 2, no shuffle, no preprocessing

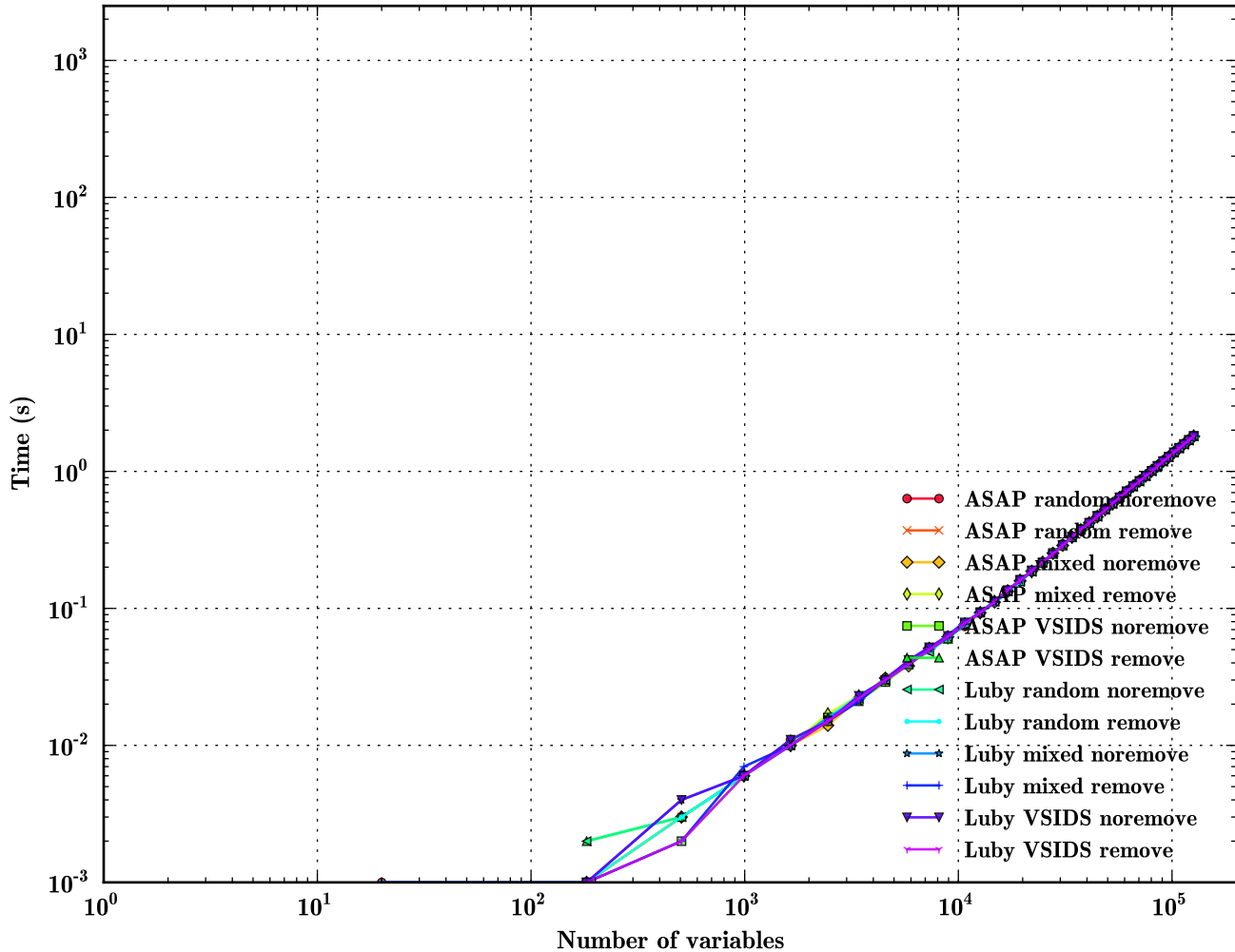




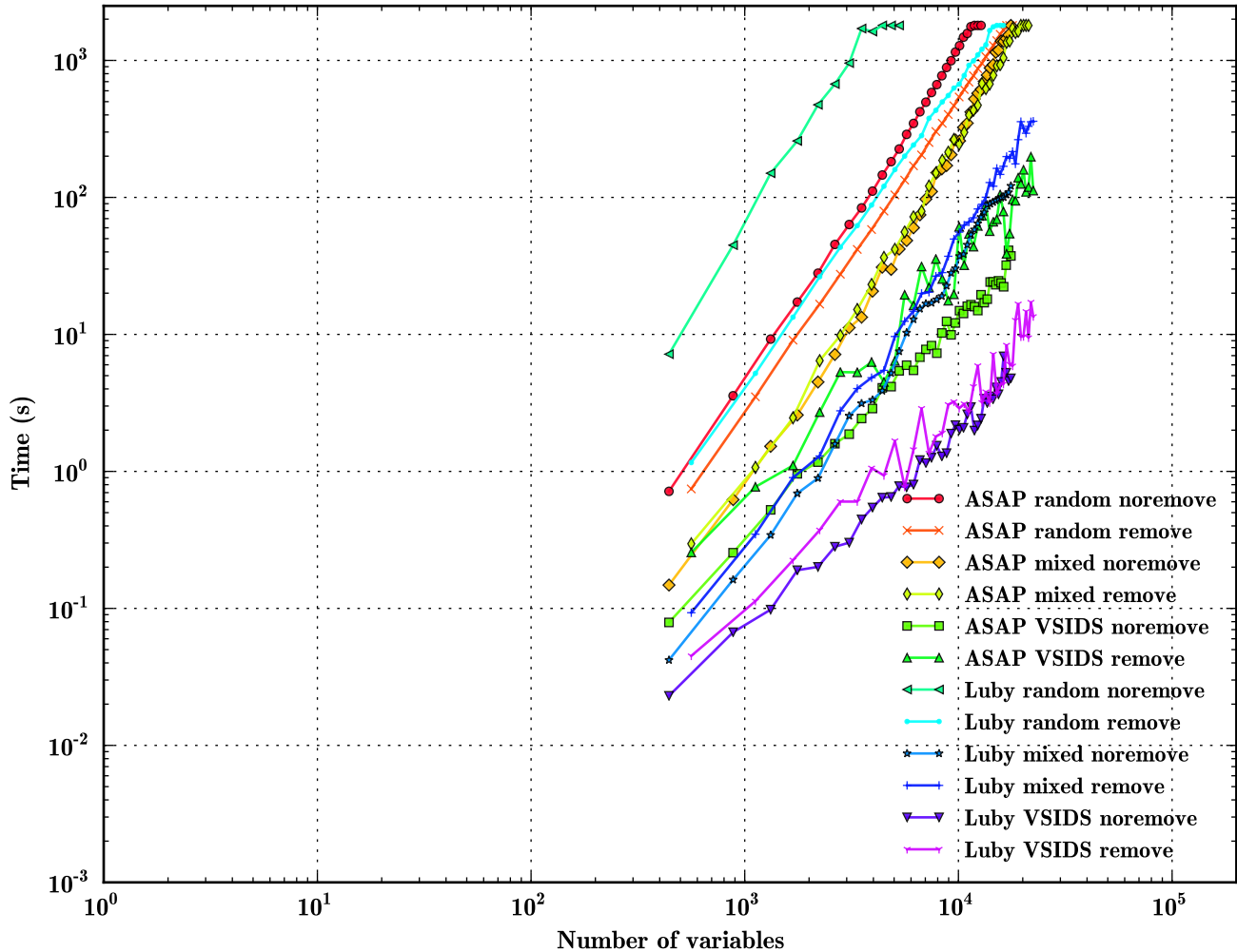
Pebbling formulas, pyramid graphs, substitution or 2, no shuffle, preprocessing



# Pebbling formulas, pyramid graphs, substitution or 2, shuffle, preprocessing



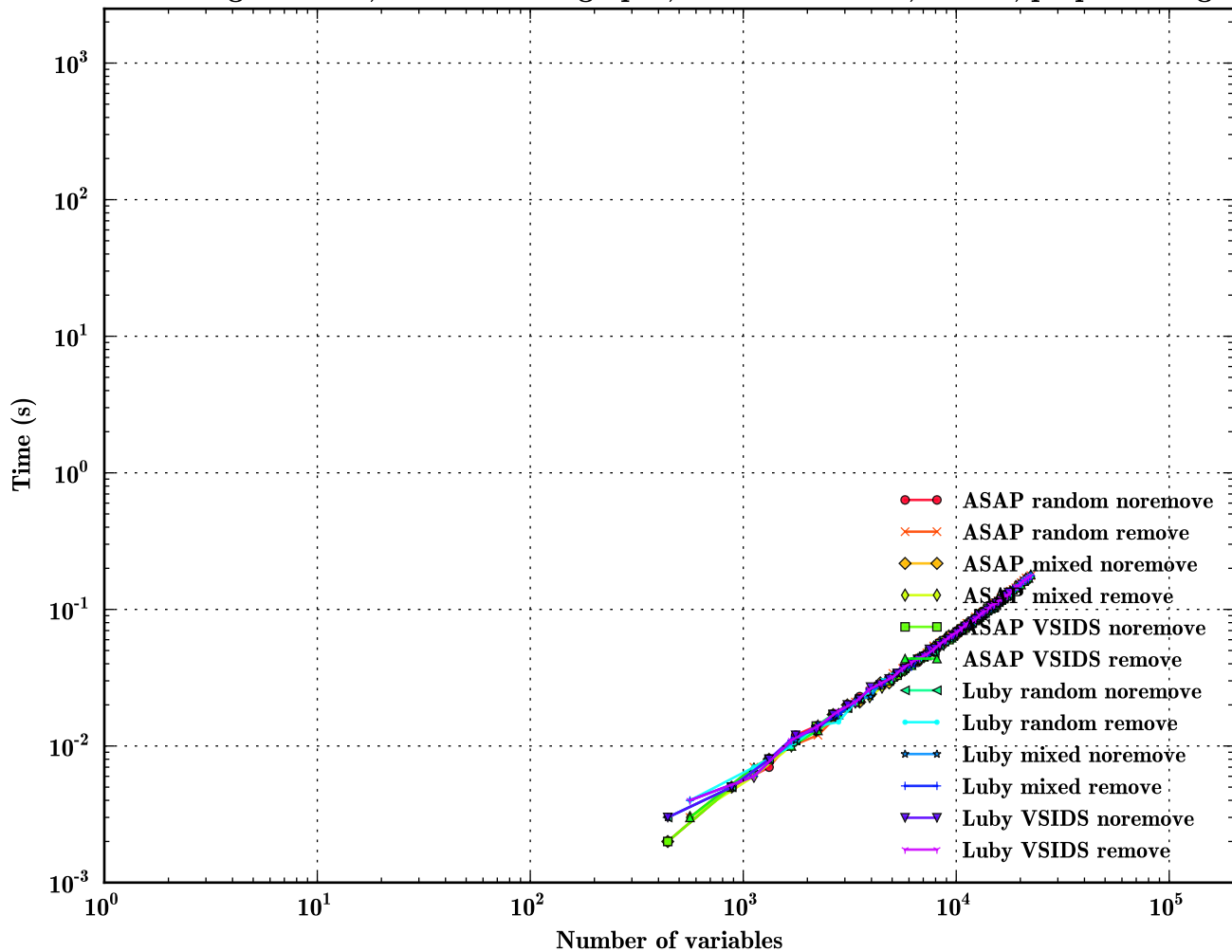
Pebbling formulas, width 2 chain graphs, substitution or 2, no shuffle, no preprocessing





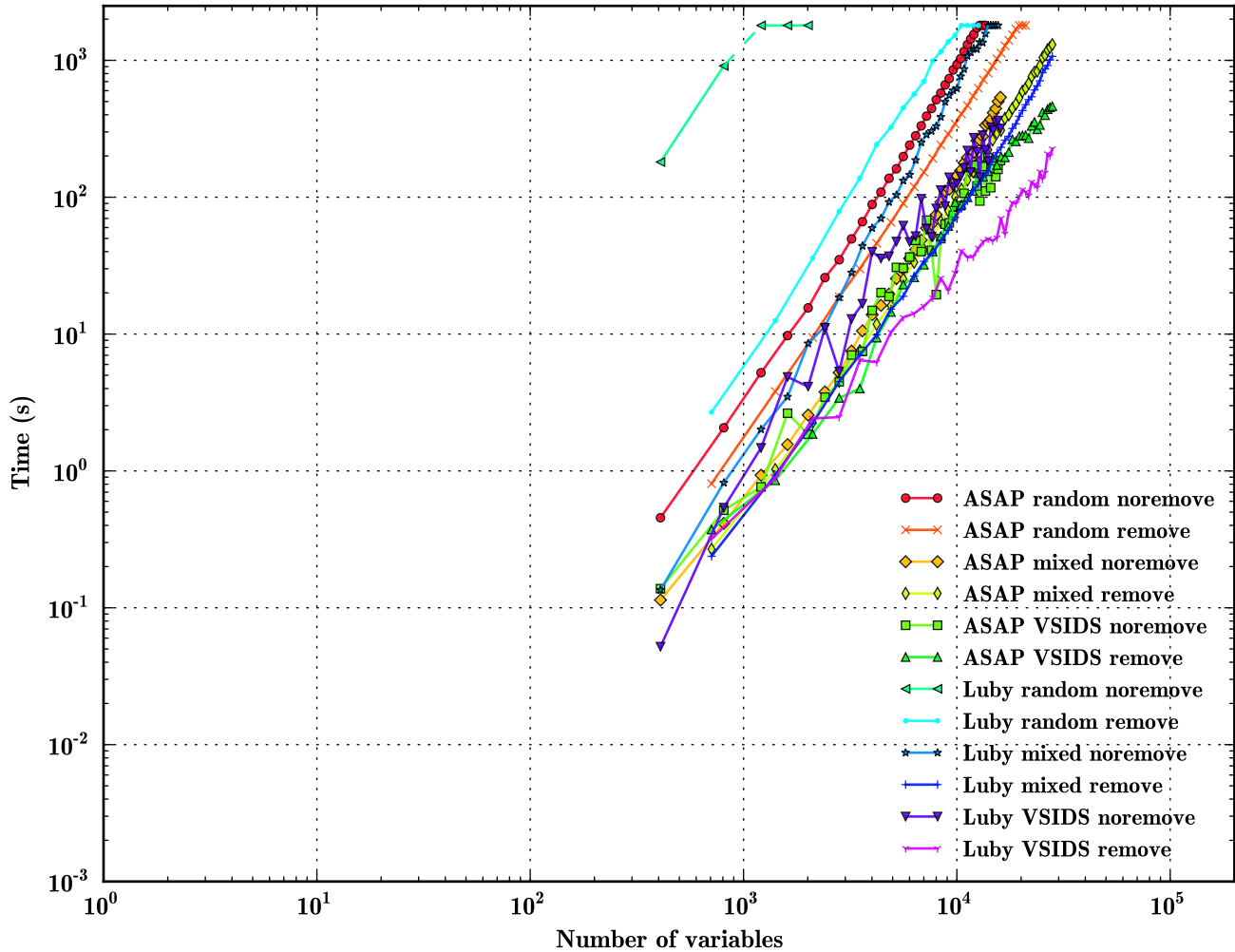


# Pebbling formulas, width 2 chain graphs, substitution or 2, shuffle, preprocessing

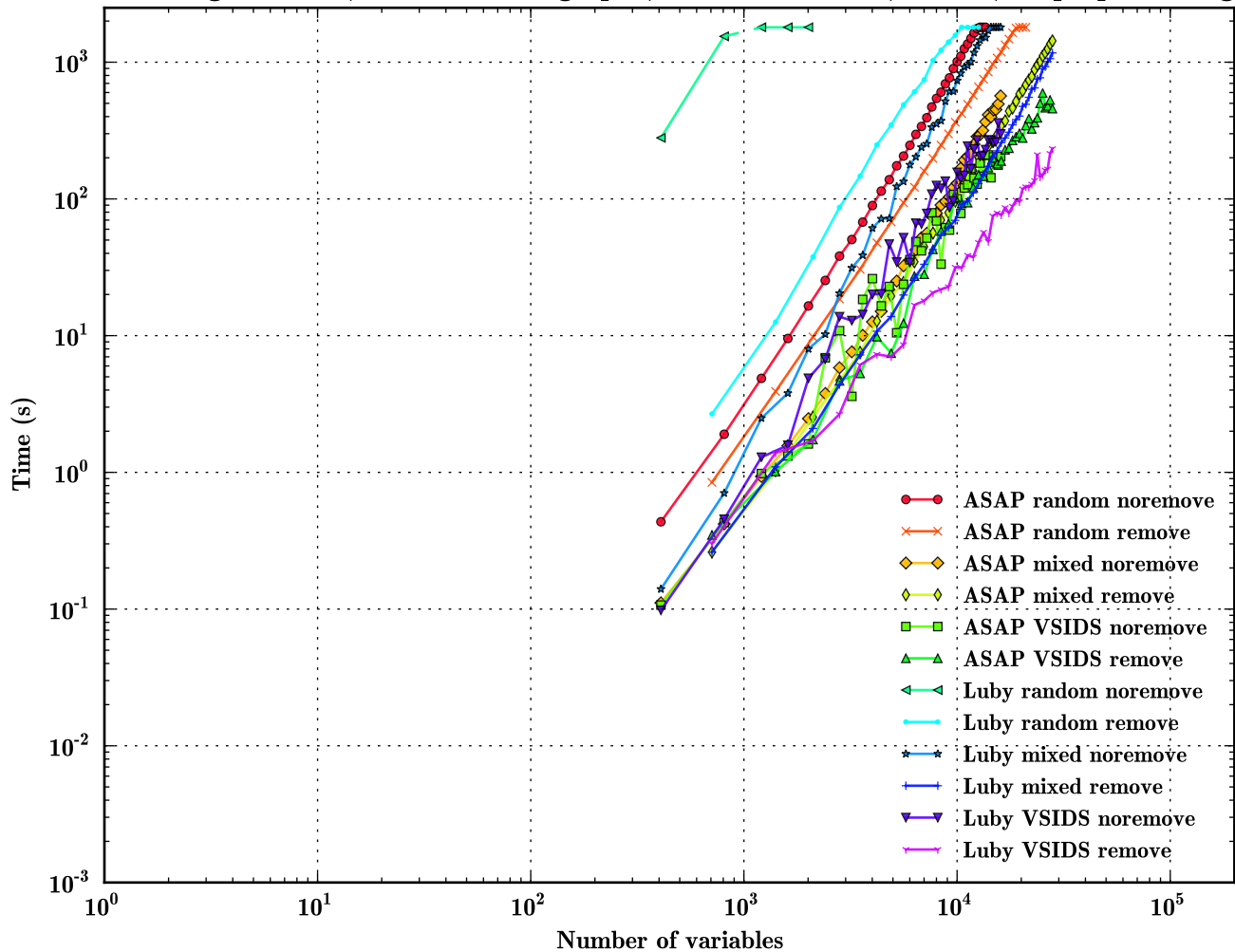




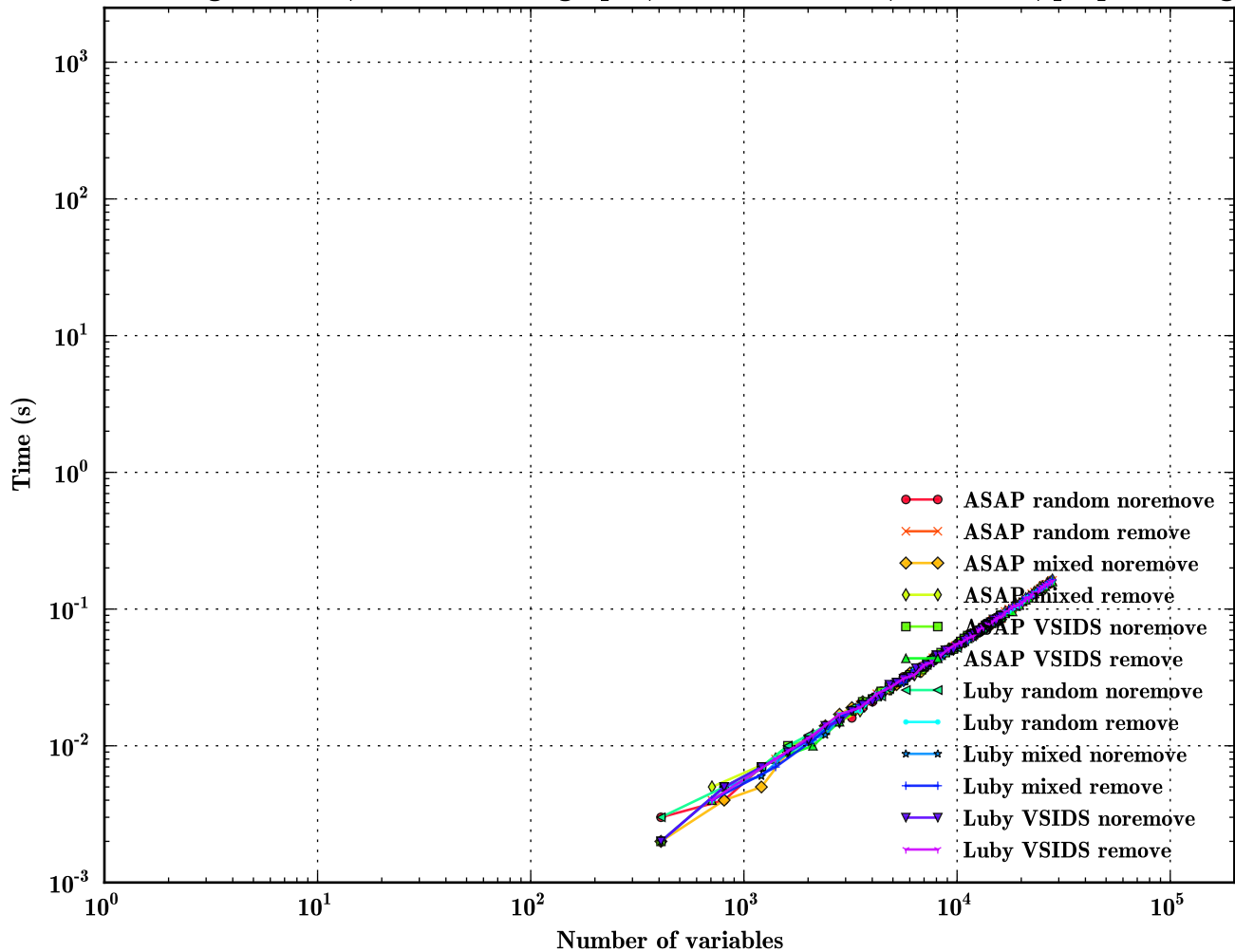
Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, no preprocessing



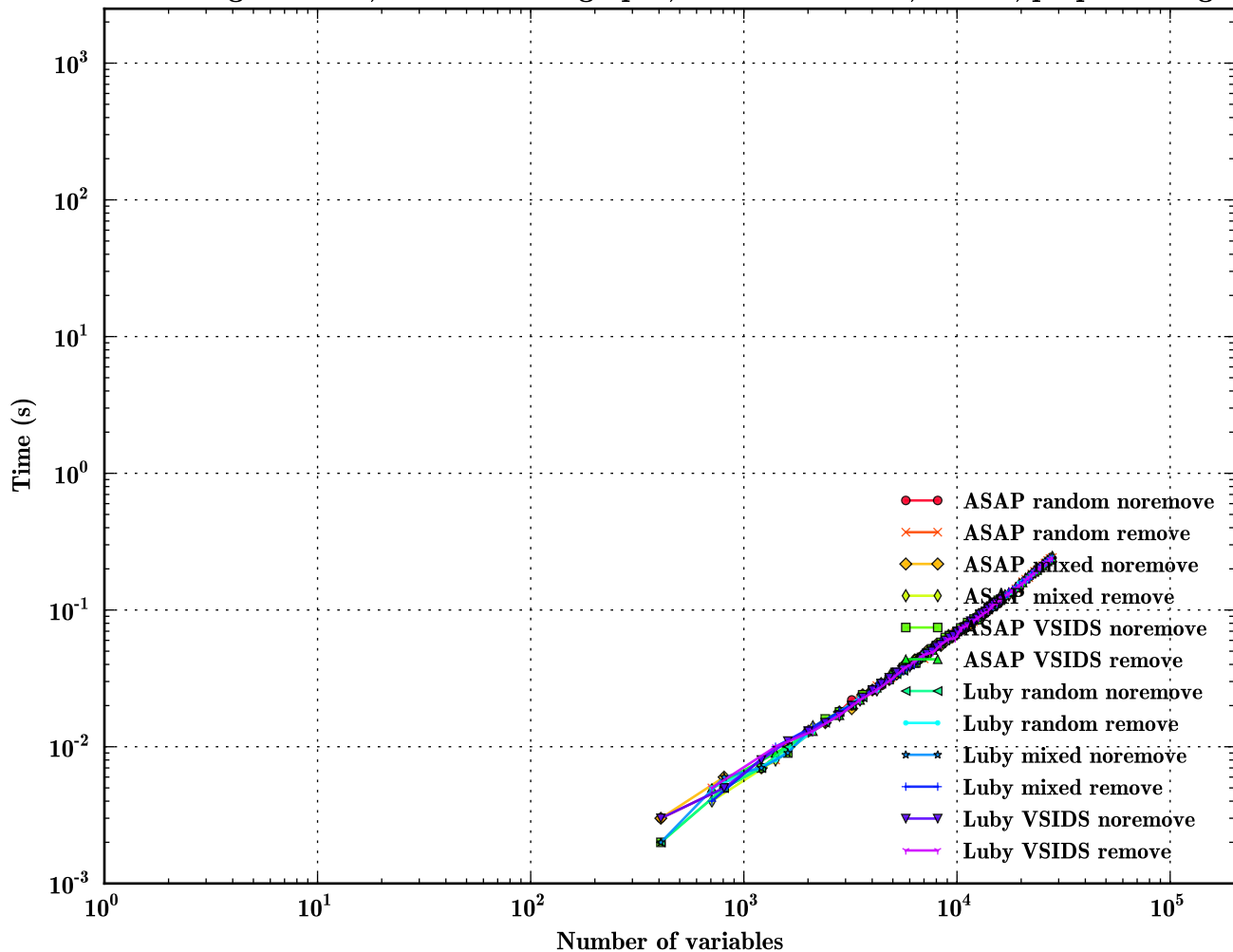
Pebbling formulas, width 5 chain graphs, substitution or 2, shuffle, no preprocessing



Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, preprocessing

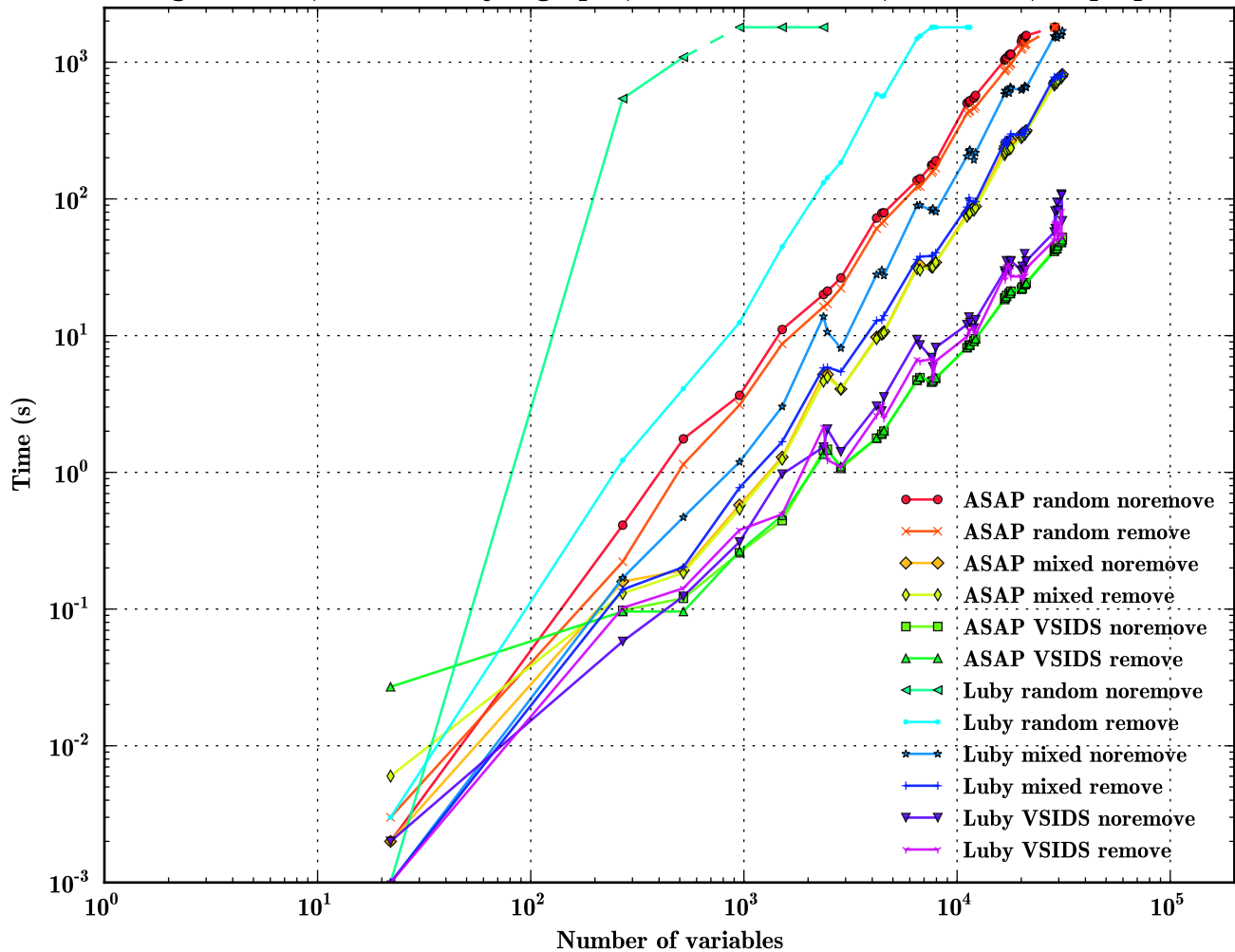


# Pebbling formulas, width 5 chain graphs, substitution or 2, shuffle, preprocessing

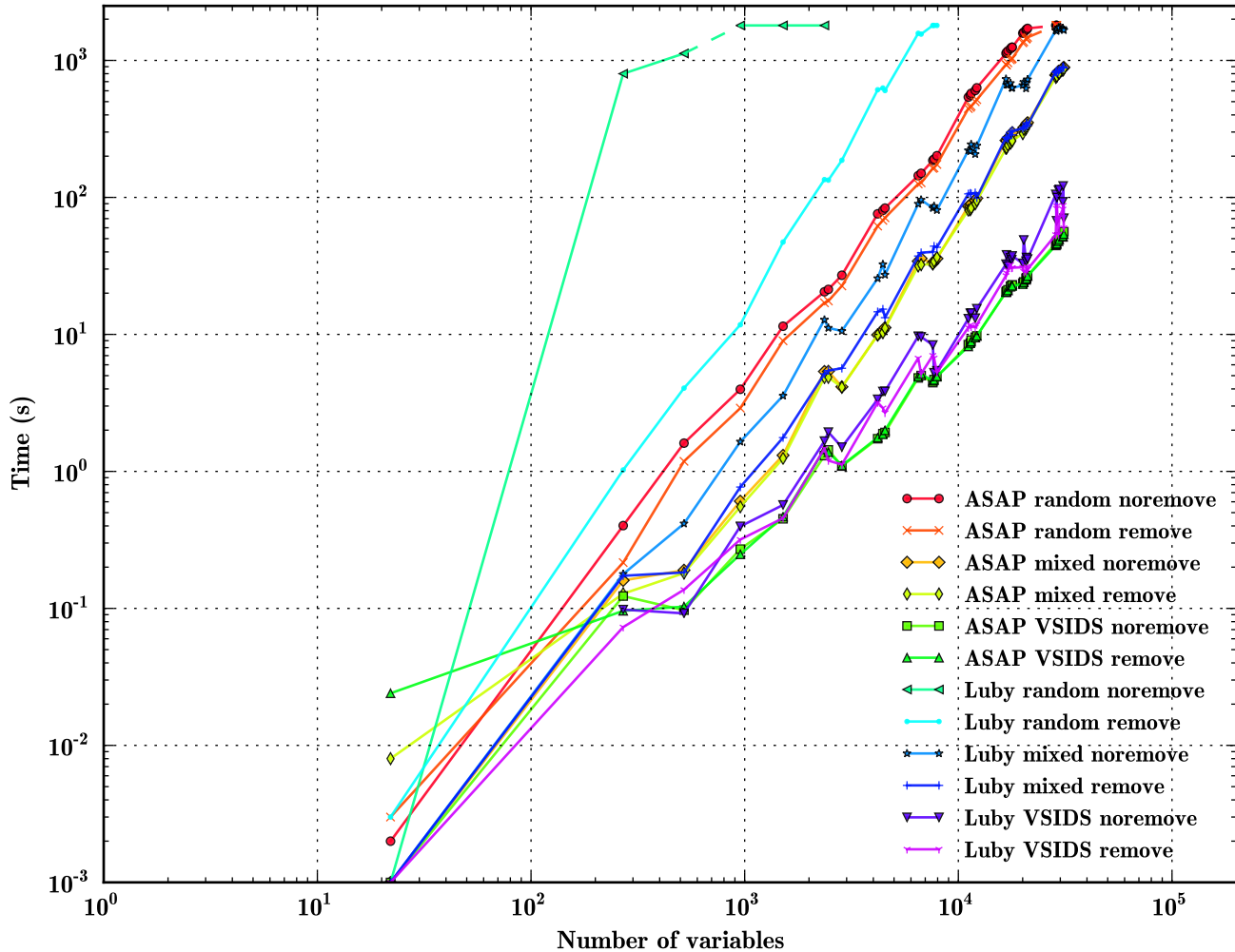


# **Pebbling formulas with substitution xor of arity 2**

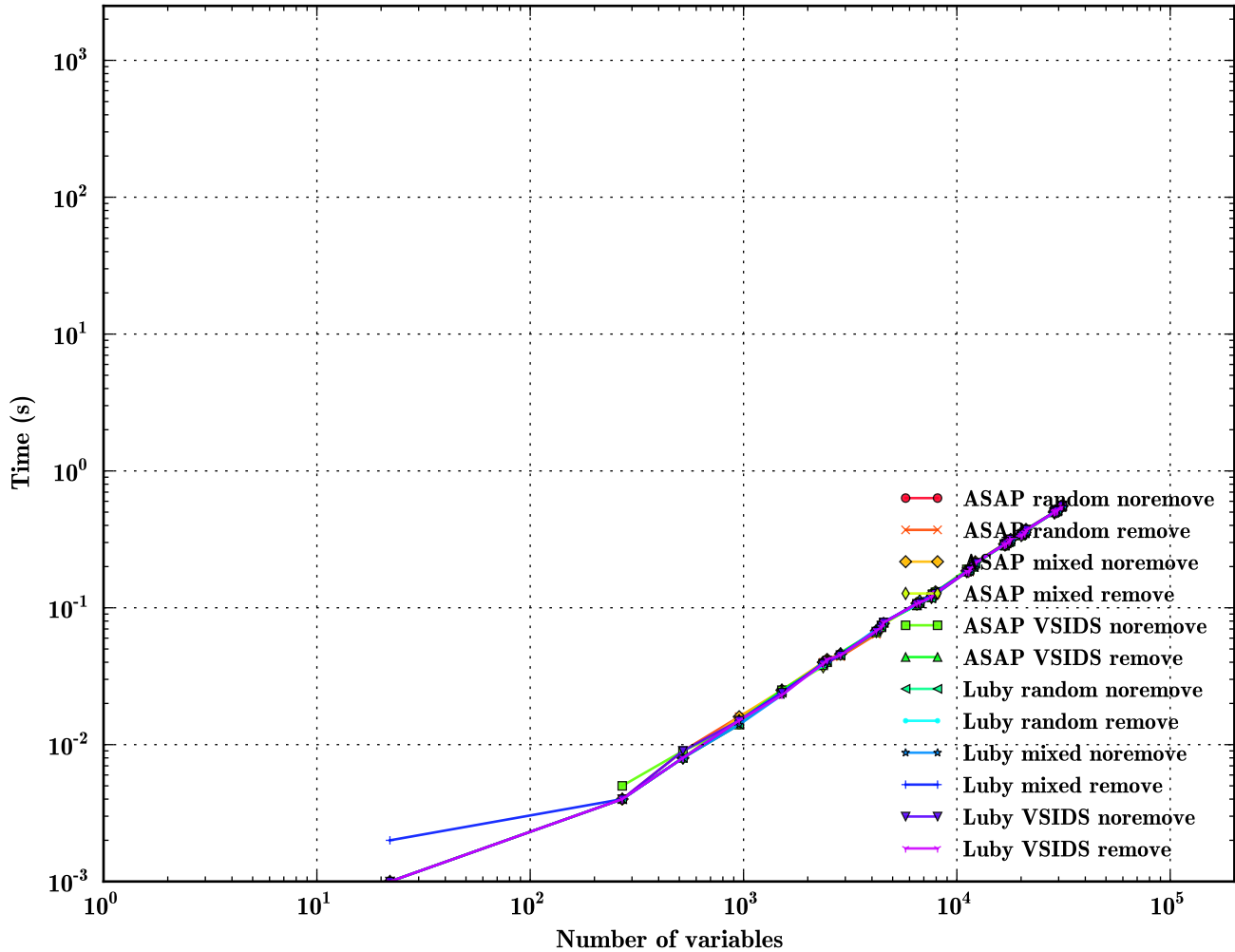
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, no shuffle, no preprocessing



Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, no preprocessing

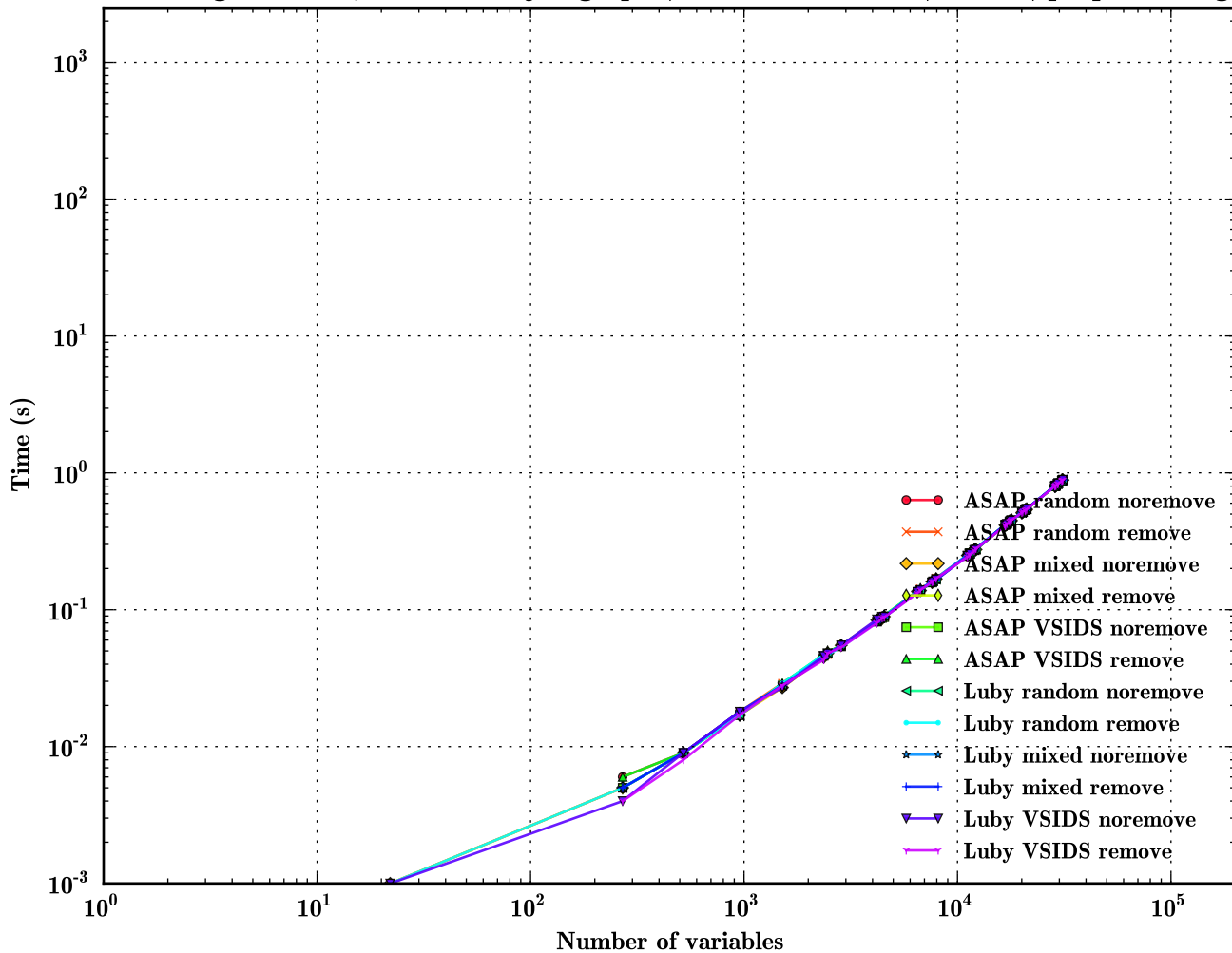


# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, no shuffle, preprocessing

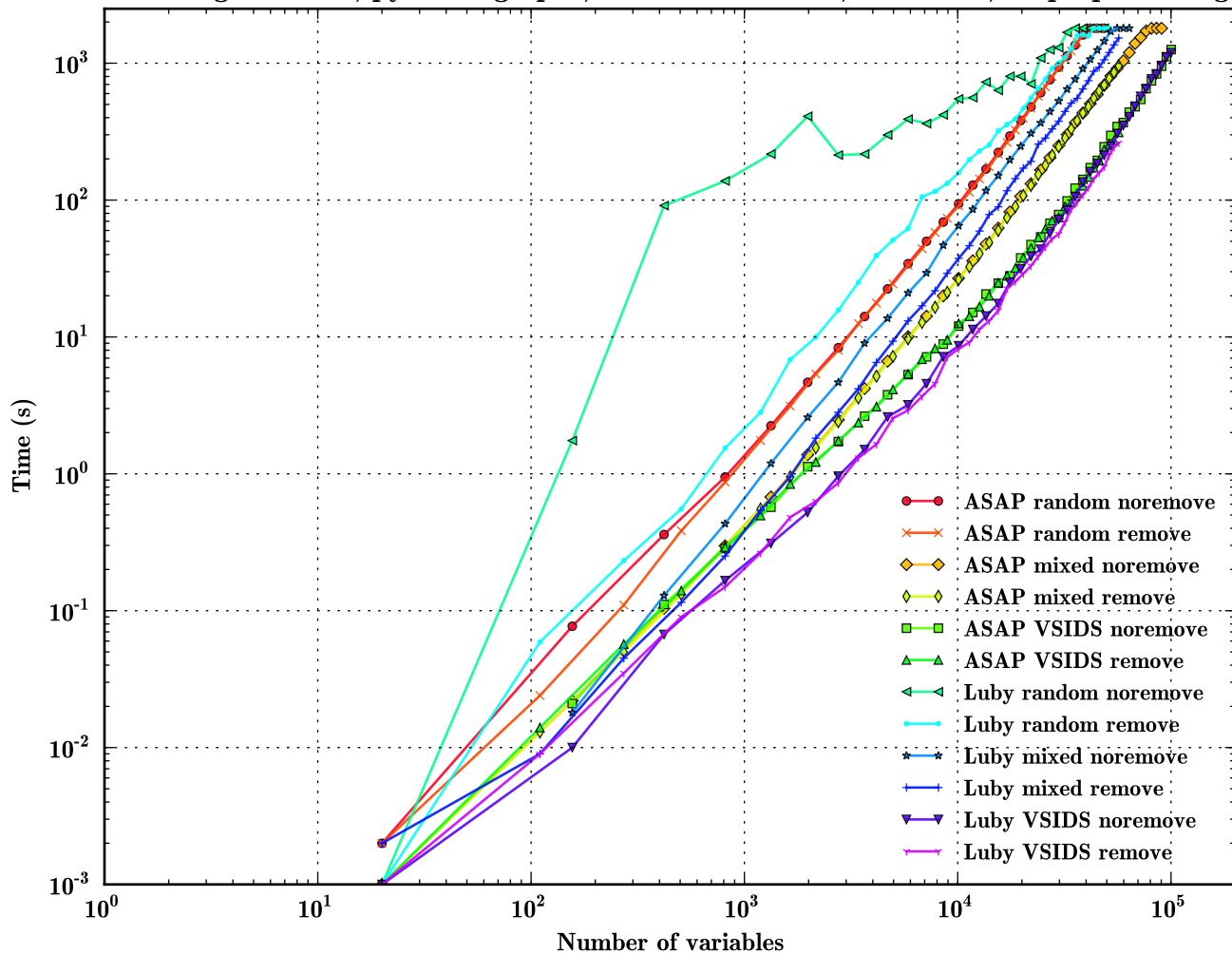




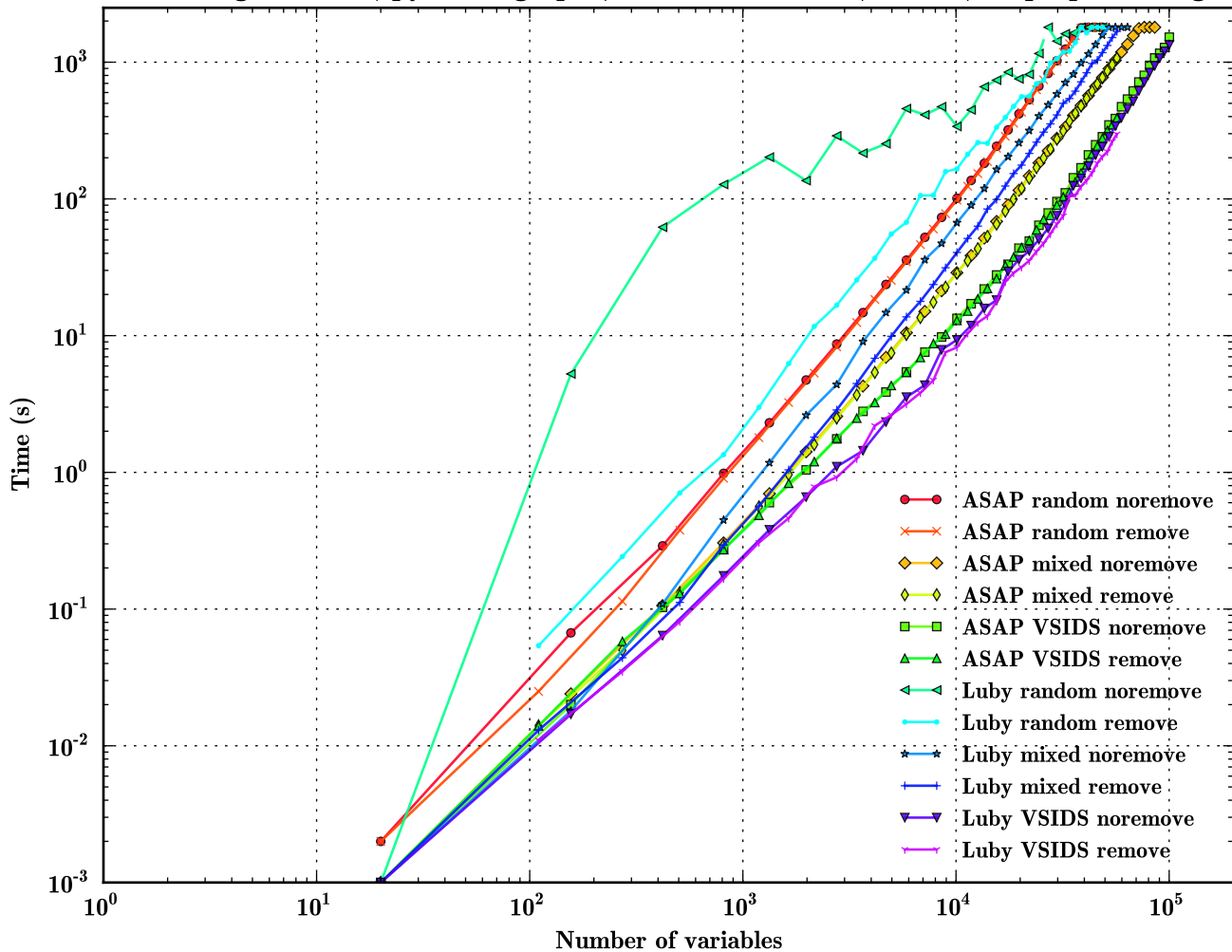
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, preprocessing



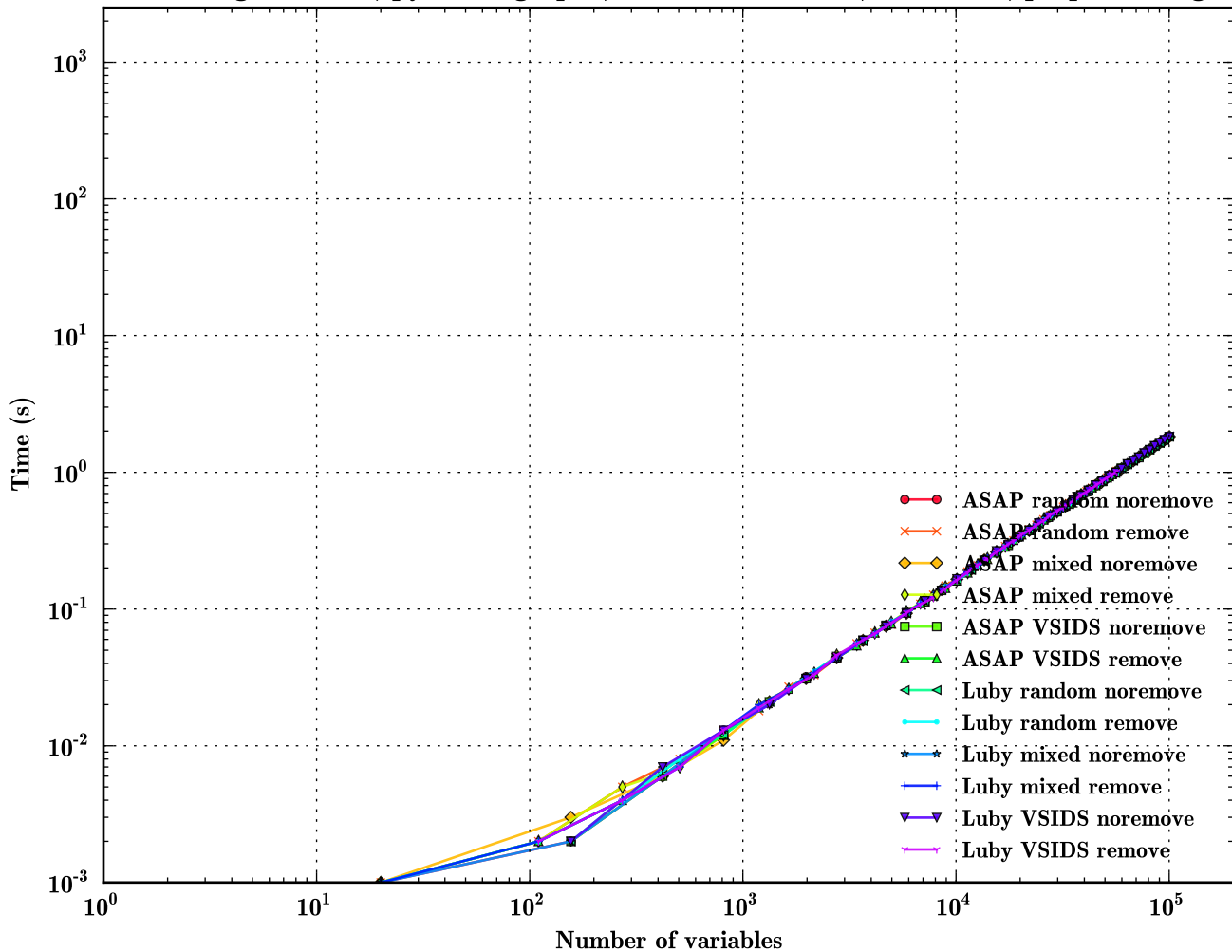
Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, no preprocessing



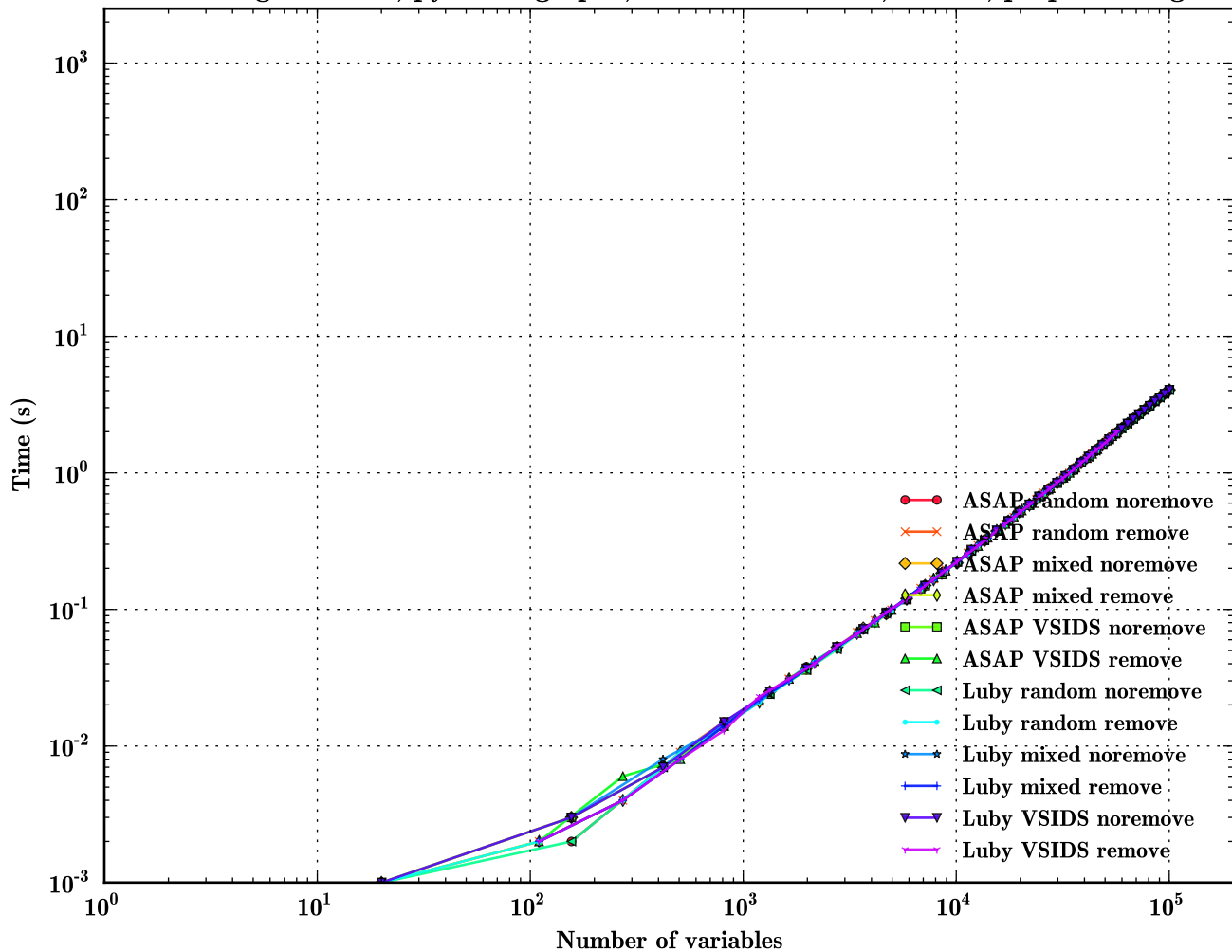
Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, no preprocessing



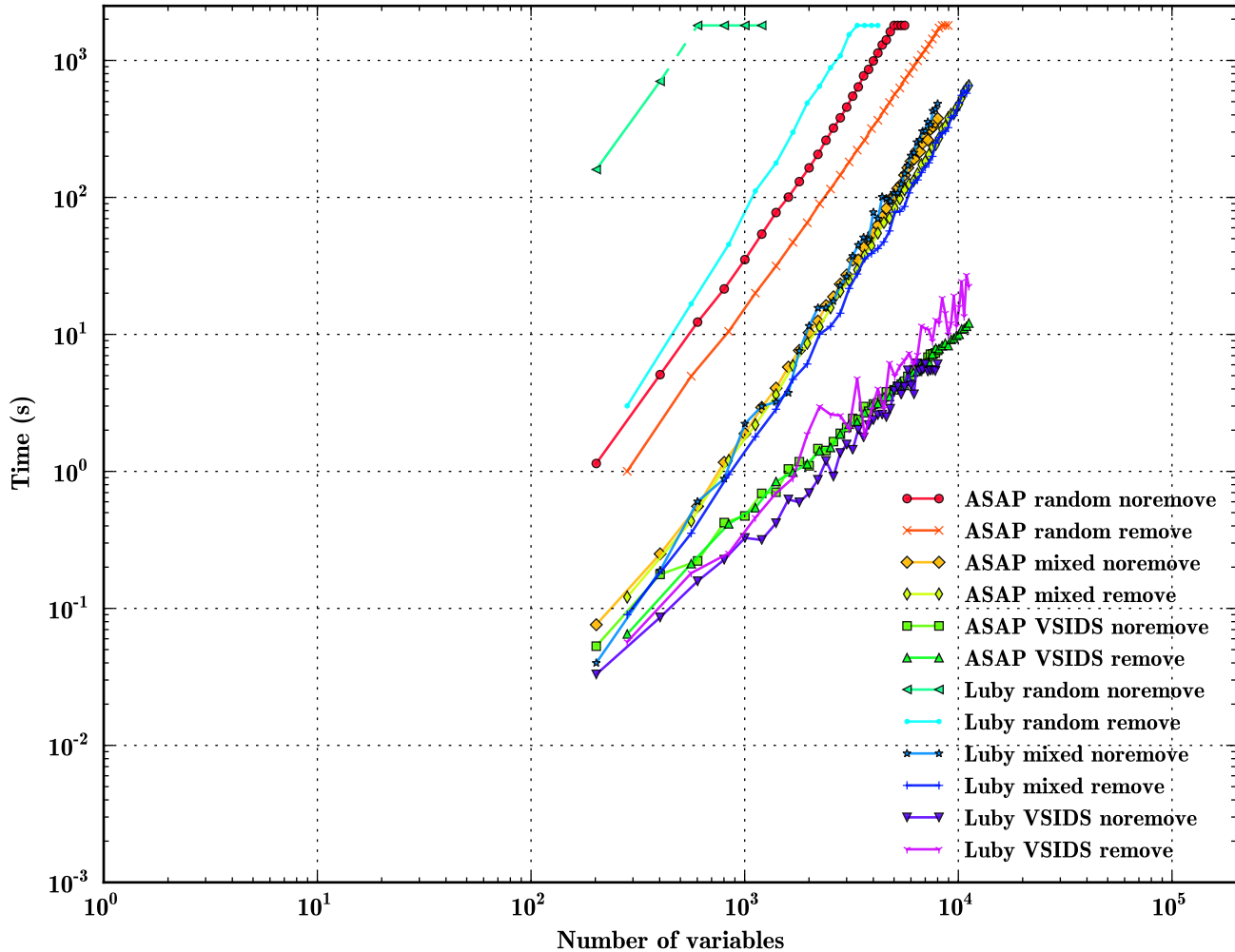
# Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, preprocessing



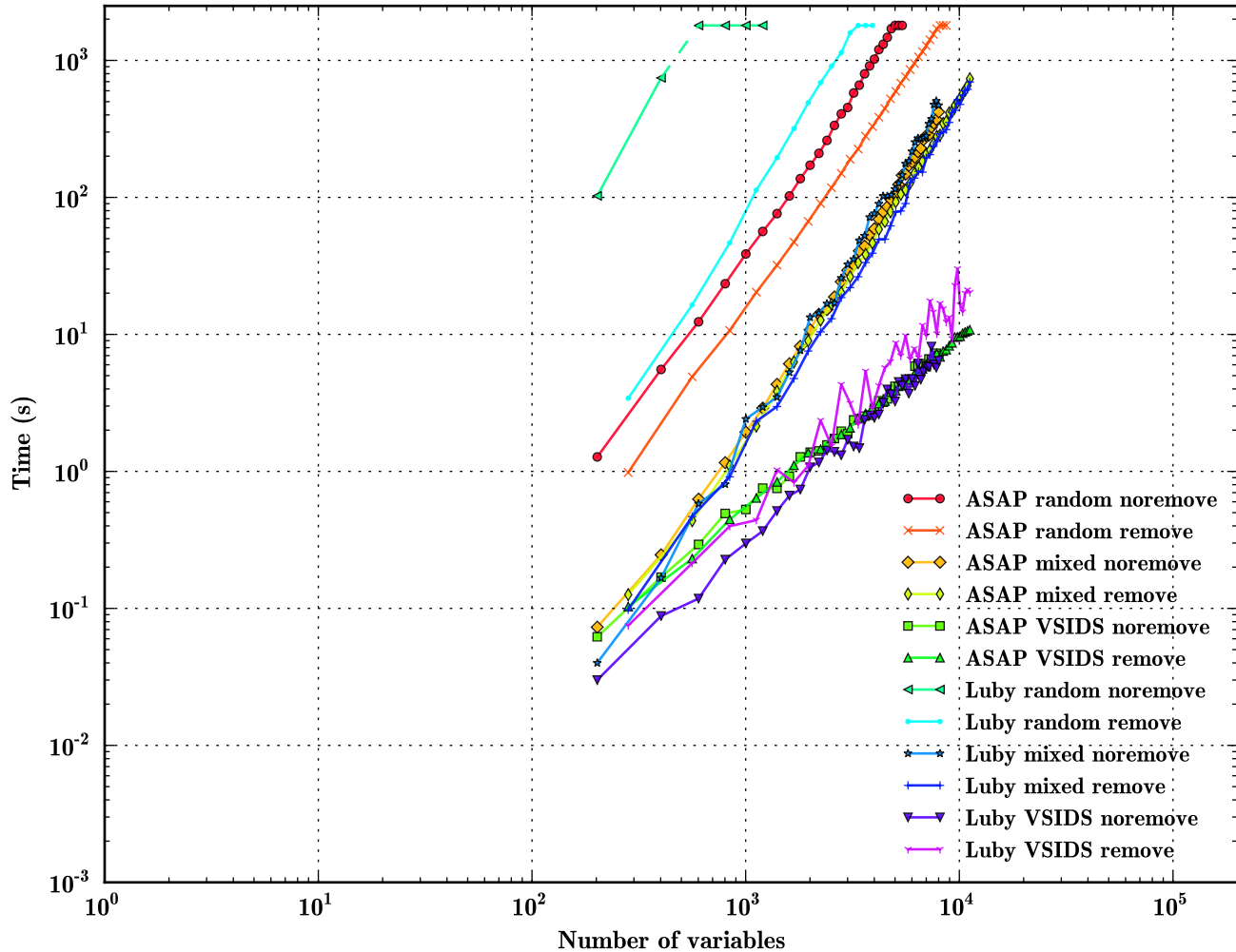
# Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, preprocessing



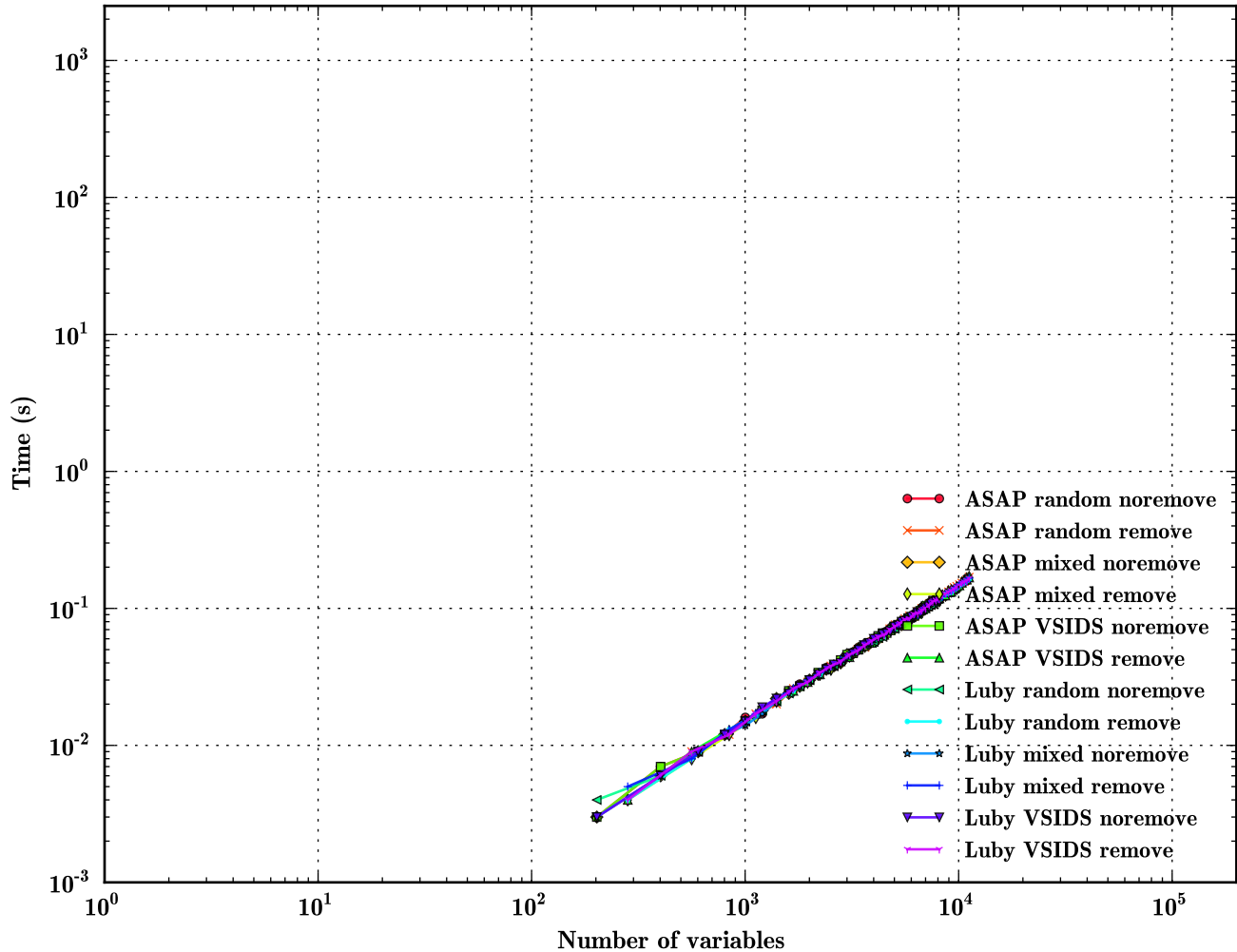
Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, no preprocessing



Pebbling formulas, width 2 chain graphs, substitution xor 2, shuffle, no preprocessing

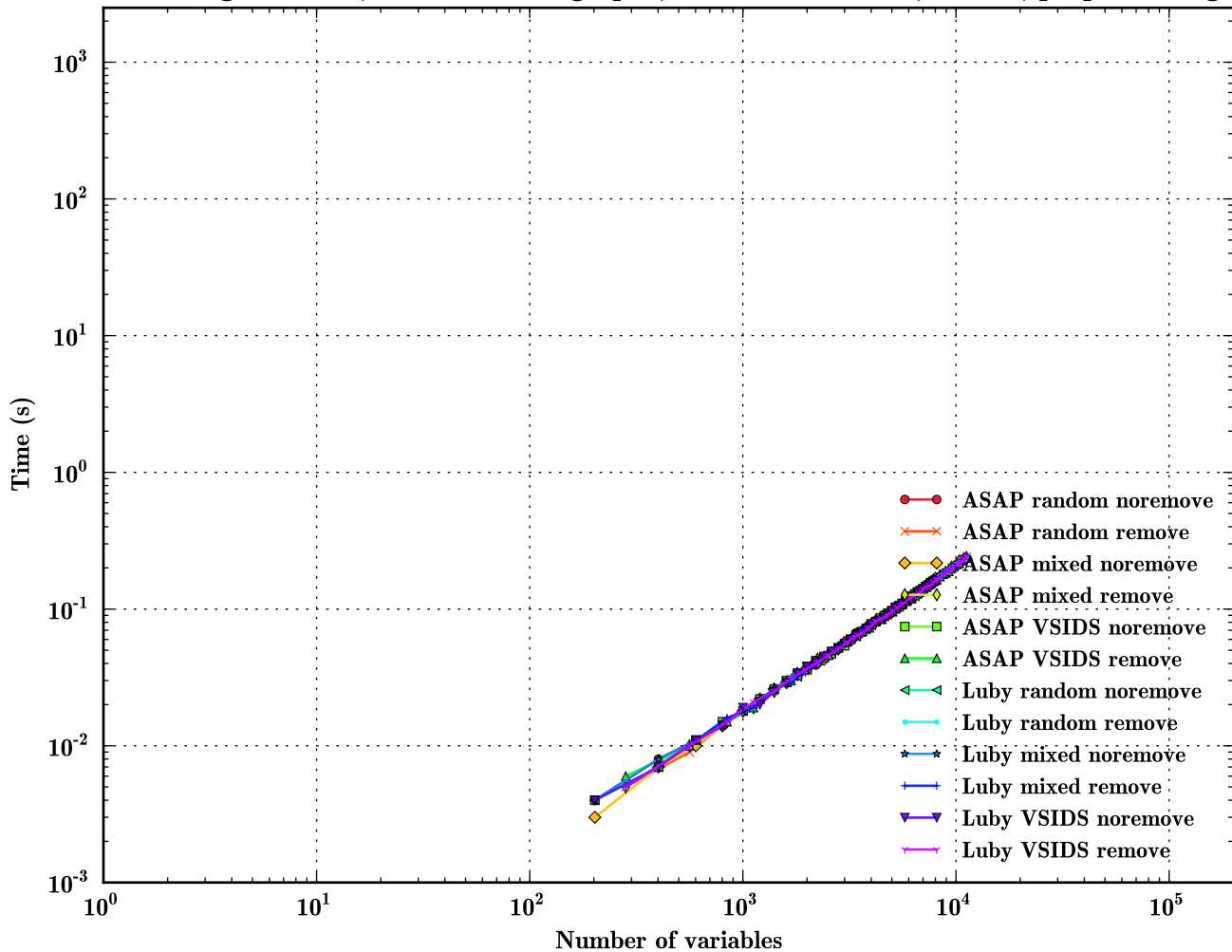


# Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, preprocessing





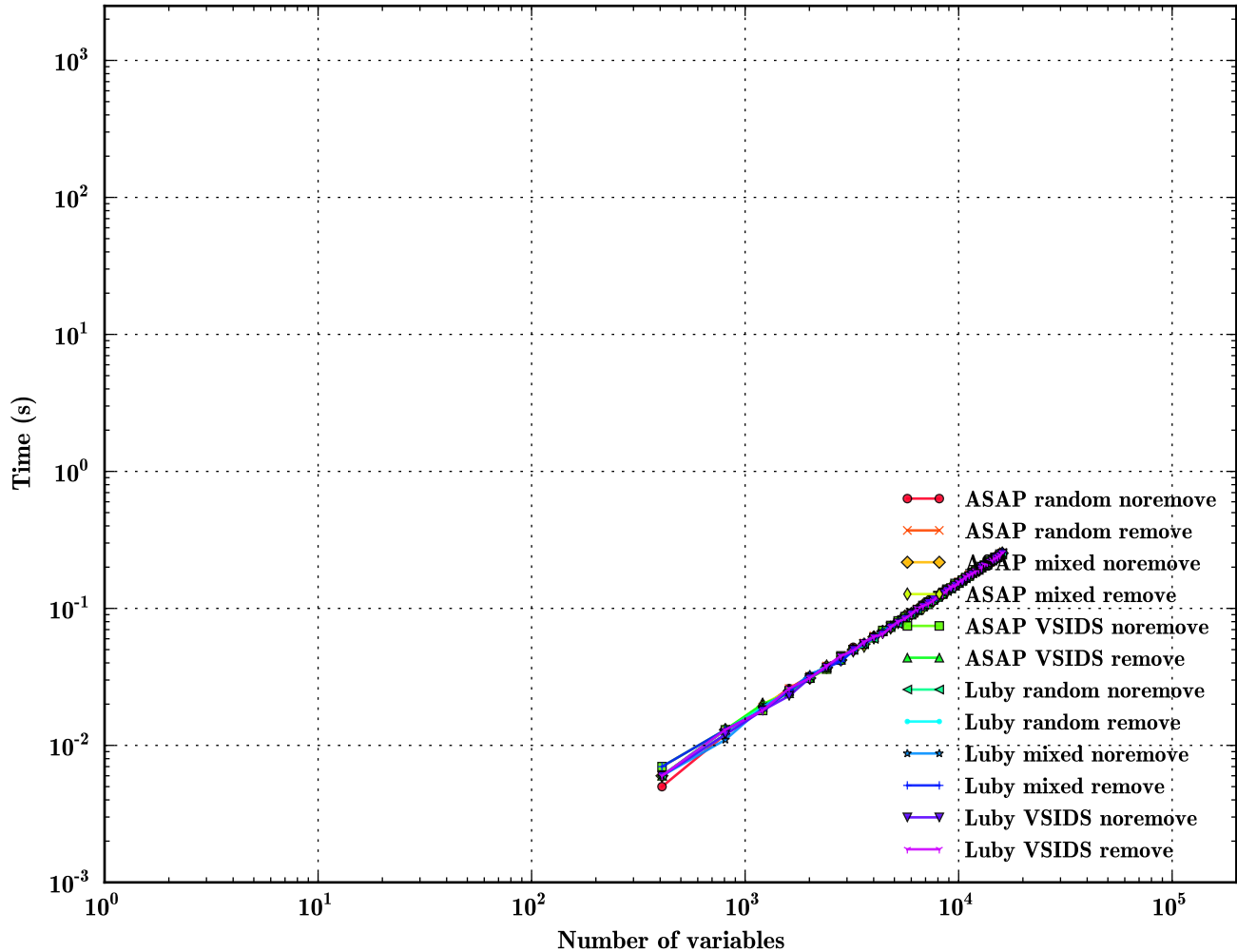
Pebbling formulas, width 2 chain graphs, substitution xor 2, shuffle, preprocessing



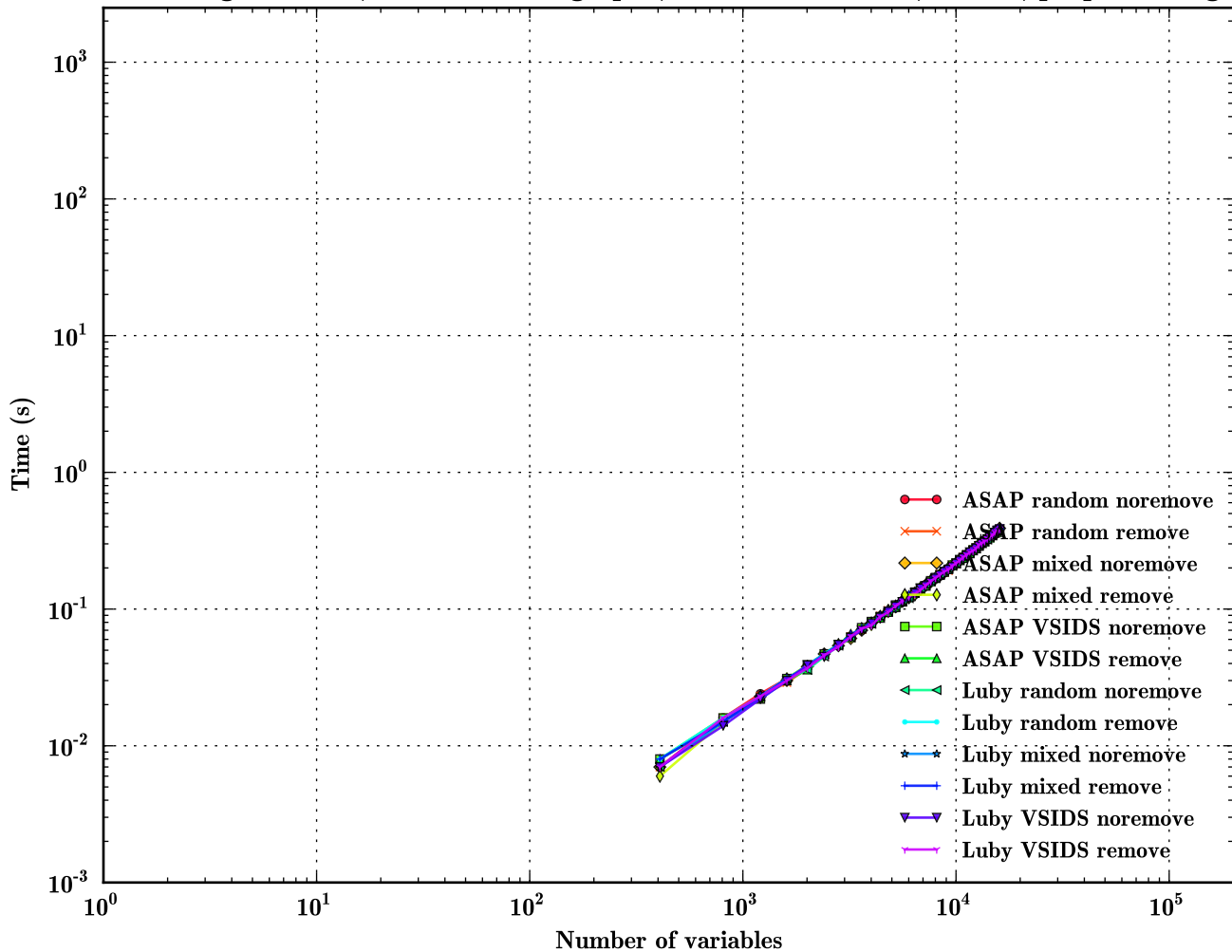




# Pebbling formulas, width 5 chain graphs, substitution xor 2, no shuffle, preprocessing



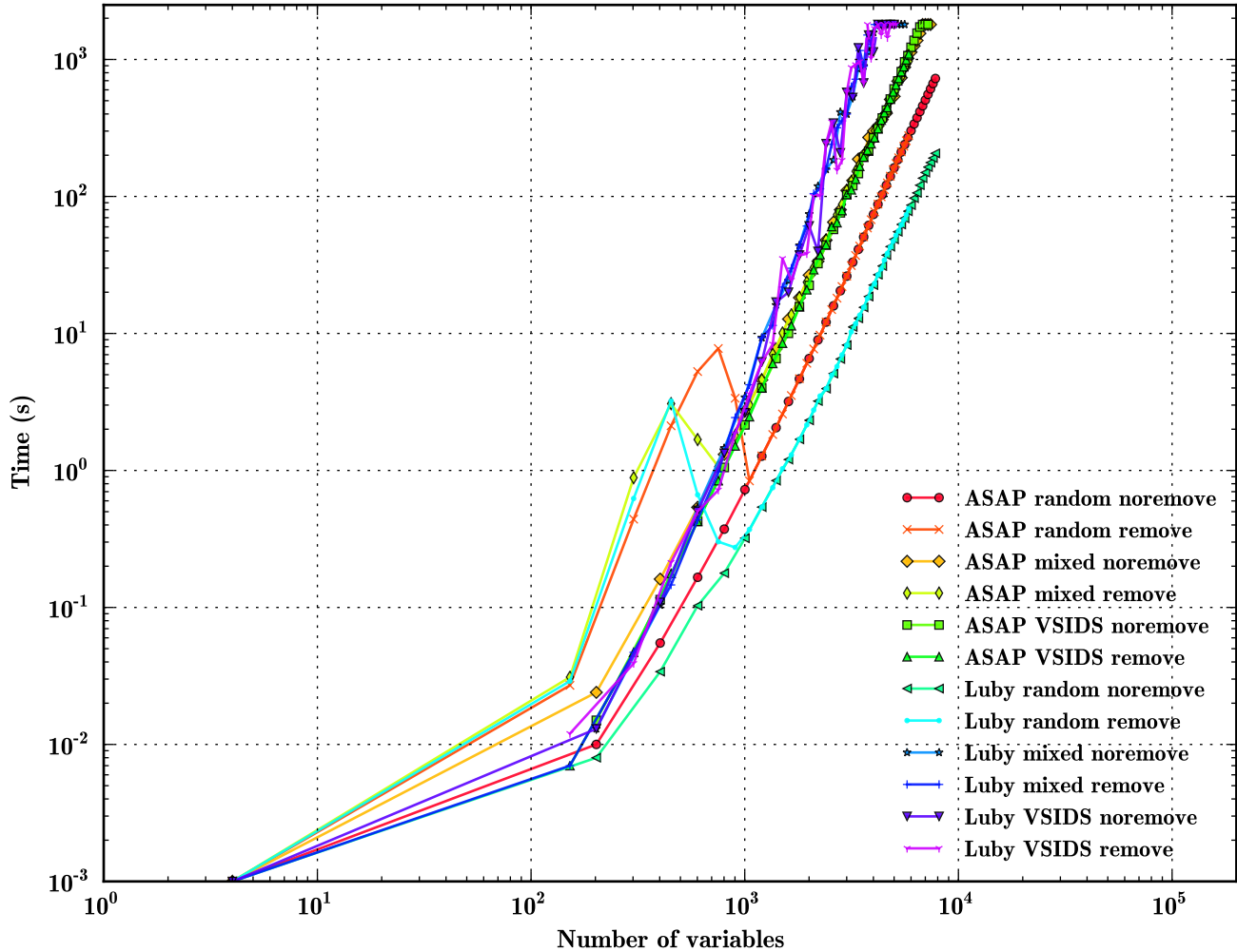
Pebbling formulas, width 5 chain graphs, substitution xor 2, shuffle, preprocessing



# **Relativized pigeonhole principle formulas (RPHP)**

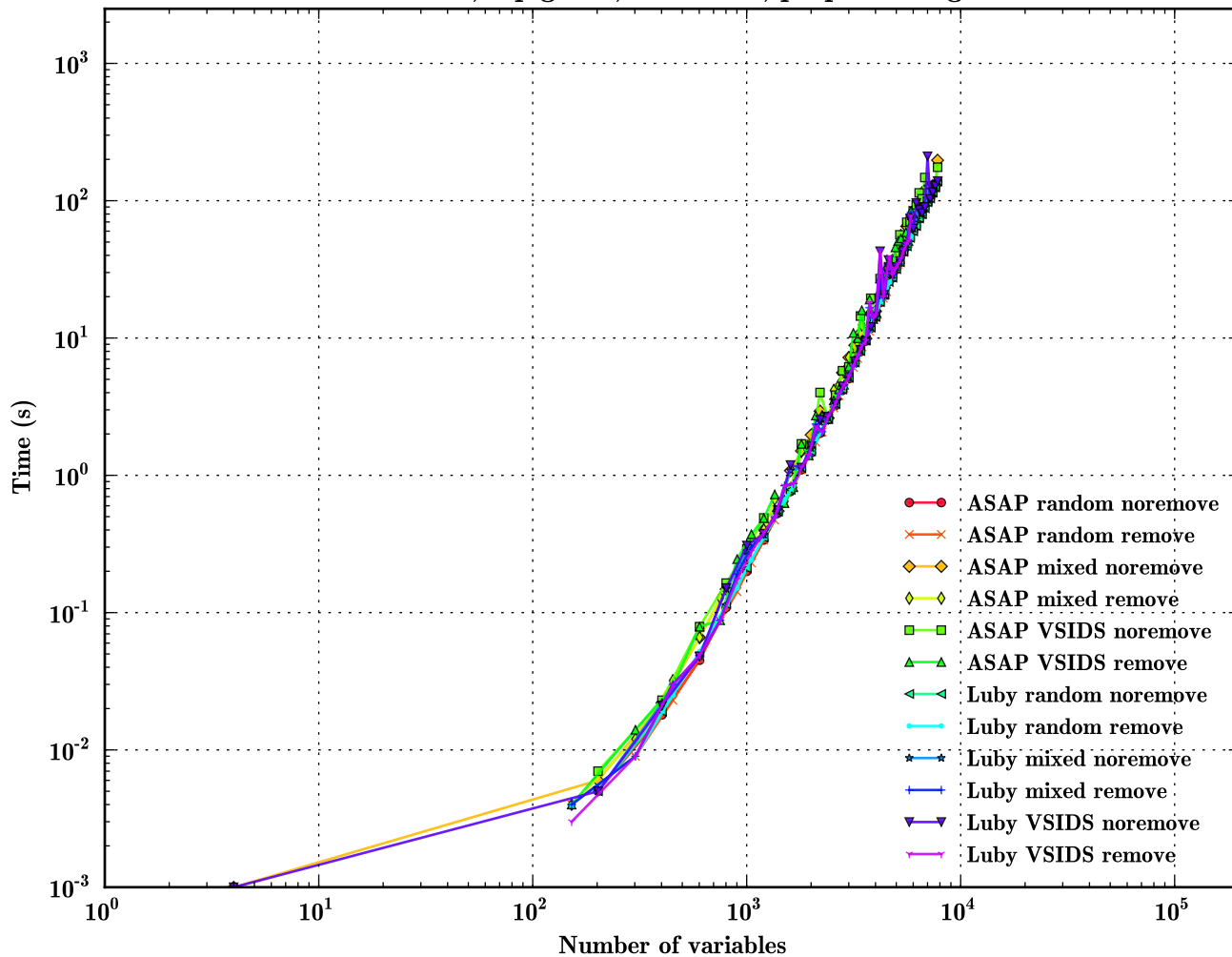


# RPHP, 2 pigeons, shuffle, no preprocessing



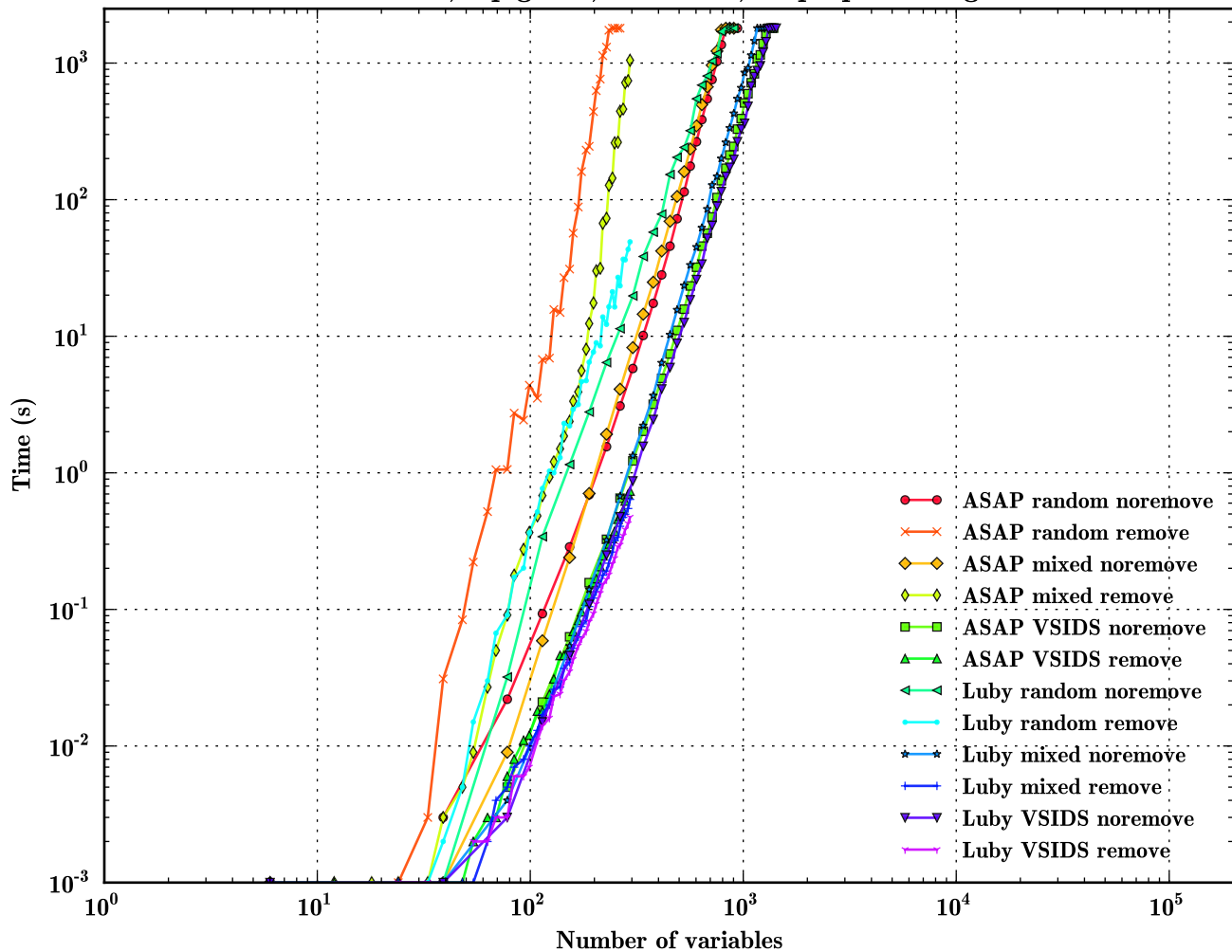


# RPHP, 2 pigeons, no shuffle, preprocessing

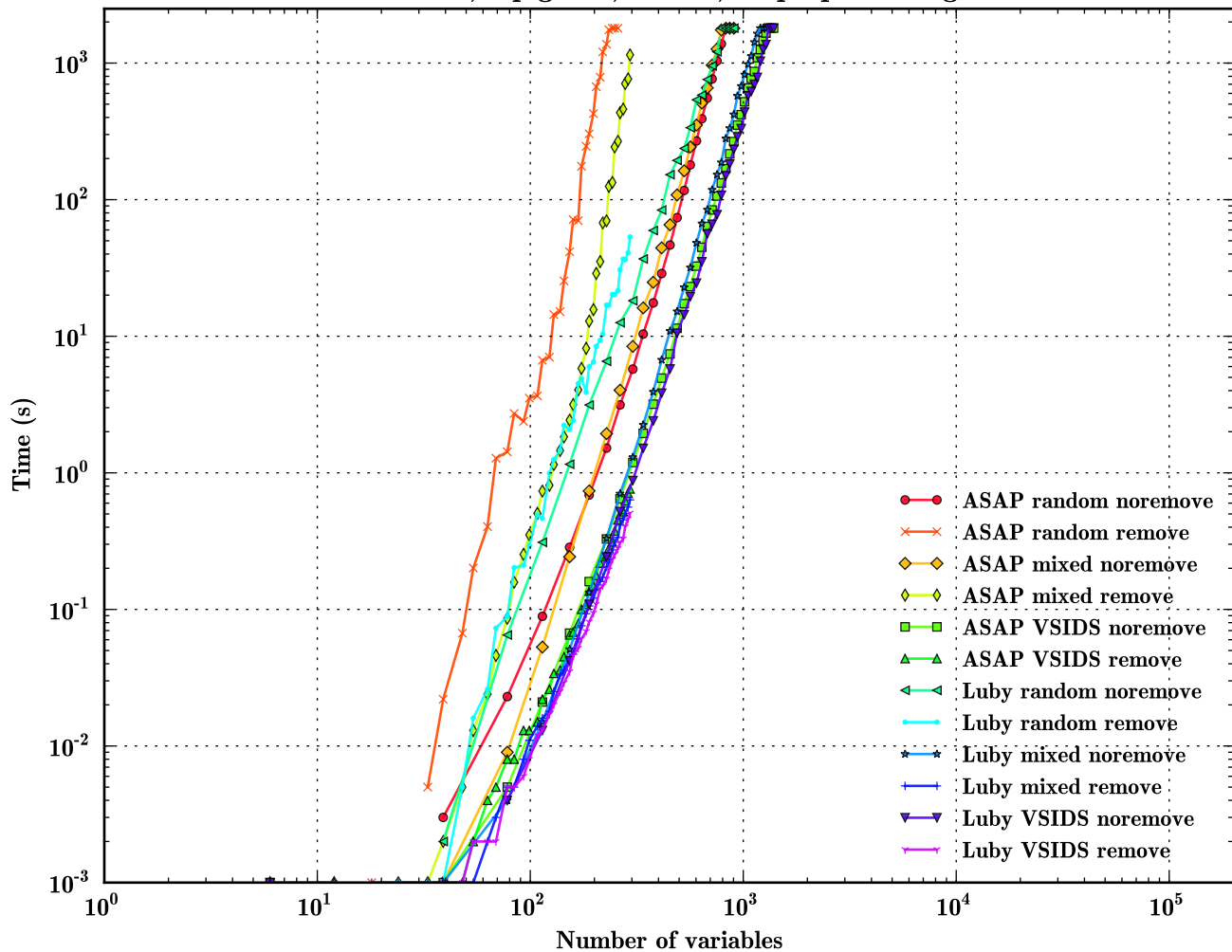




# RPHP, 3 pigeons, no shuffle, no preprocessing

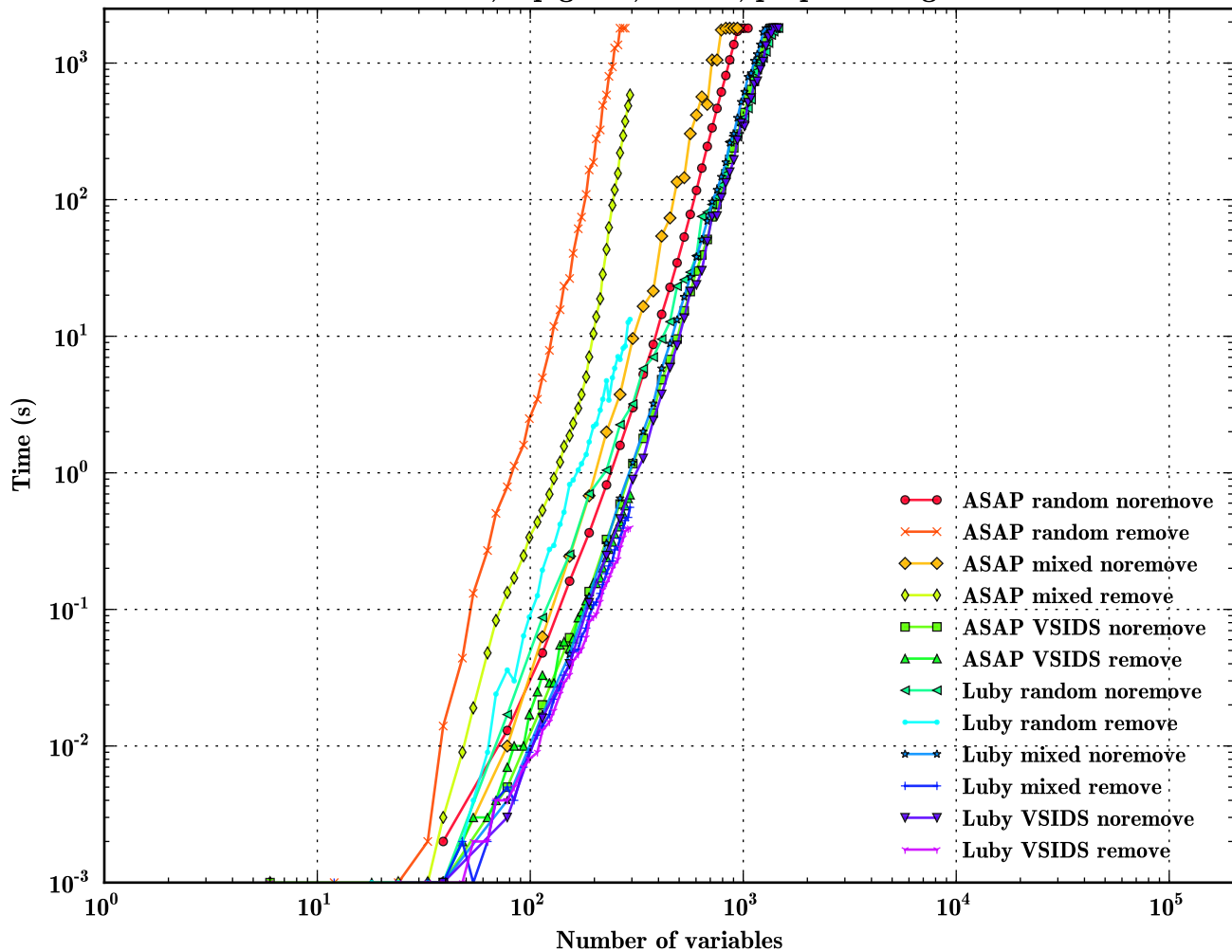


# RPHP, 3 pigeons, shuffle, no preprocessing

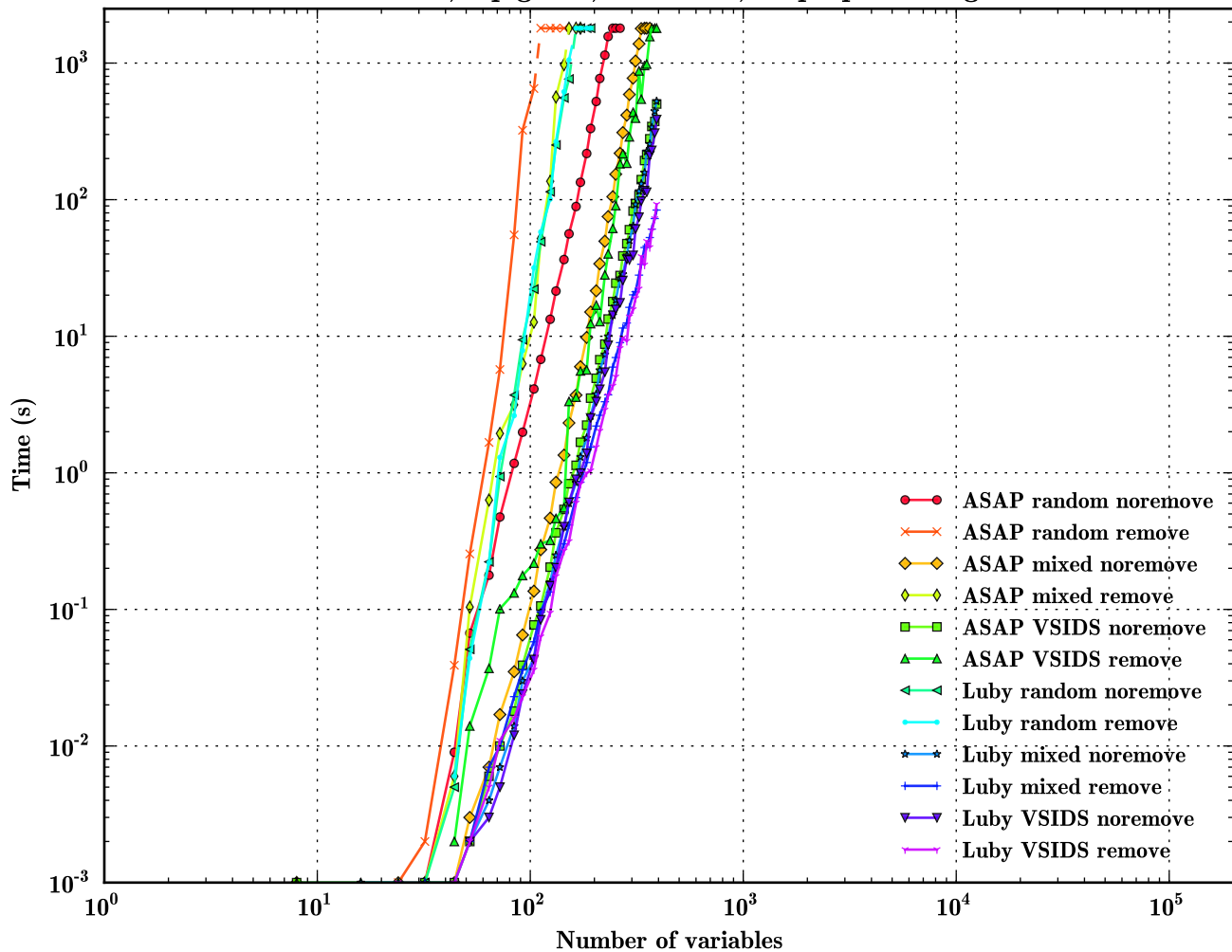




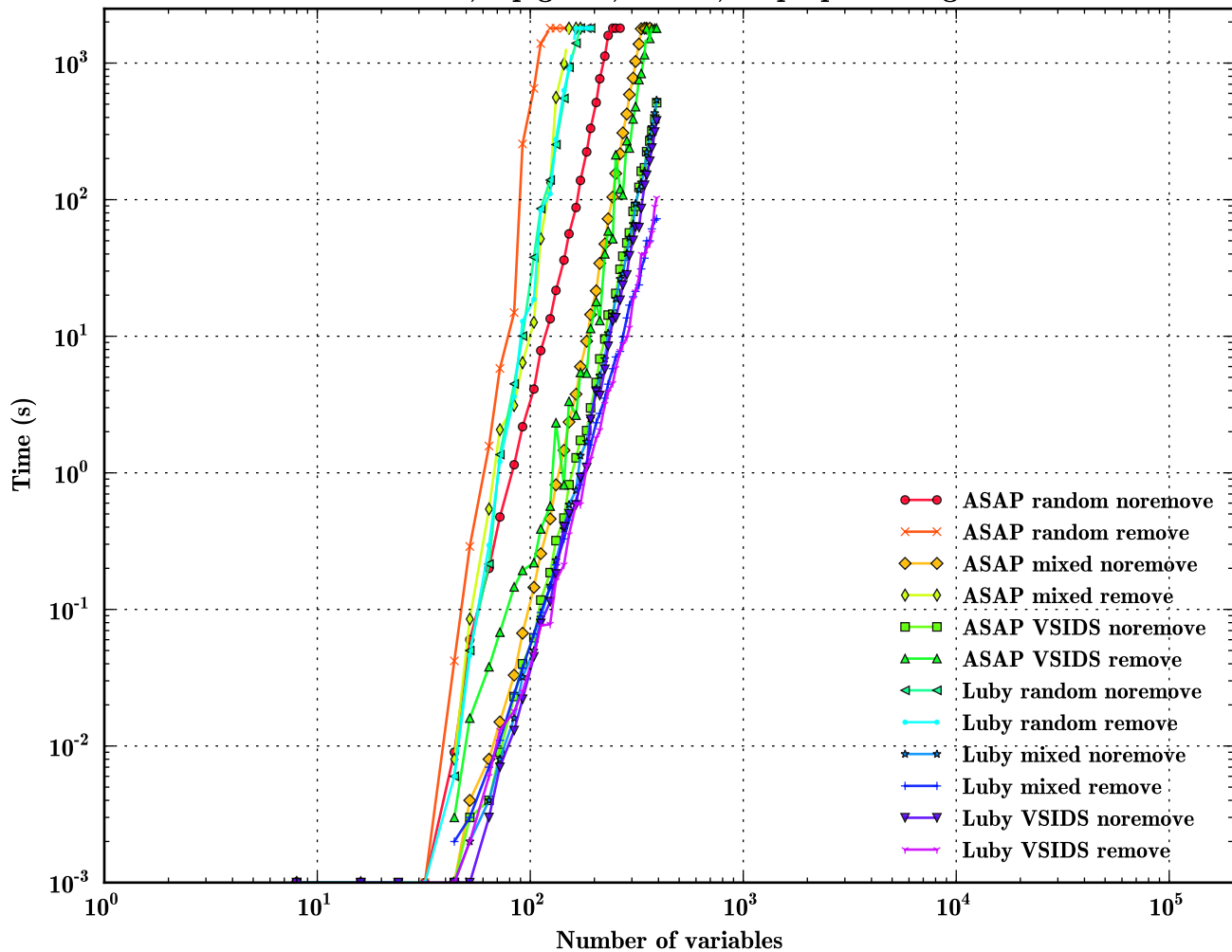
# RPHP, 3 pigeons, shuffle, preprocessing



# RPHP, 4 pigeons, no shuffle, no preprocessing

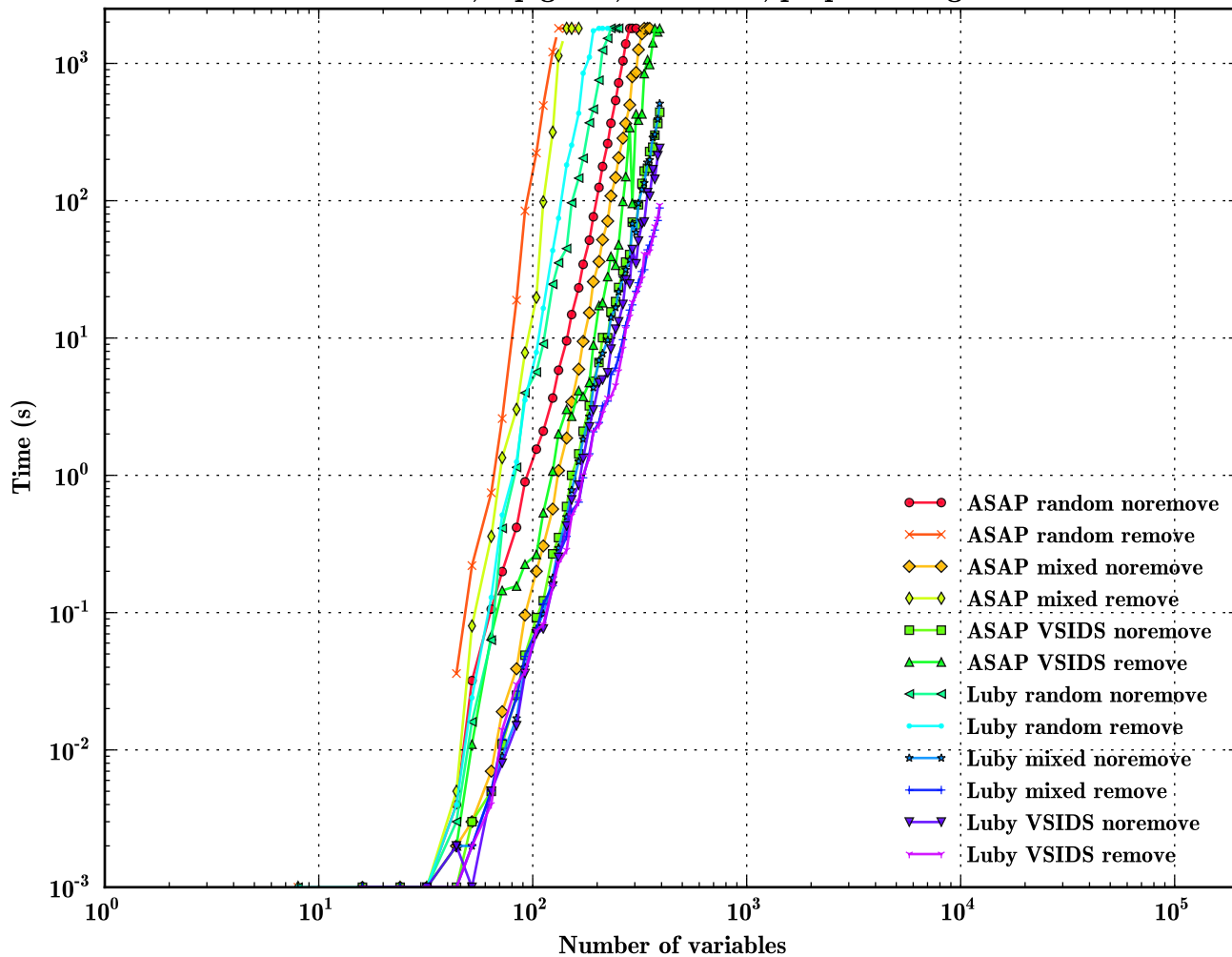


# RPHP, 4 pigeons, shuffle, no preprocessing

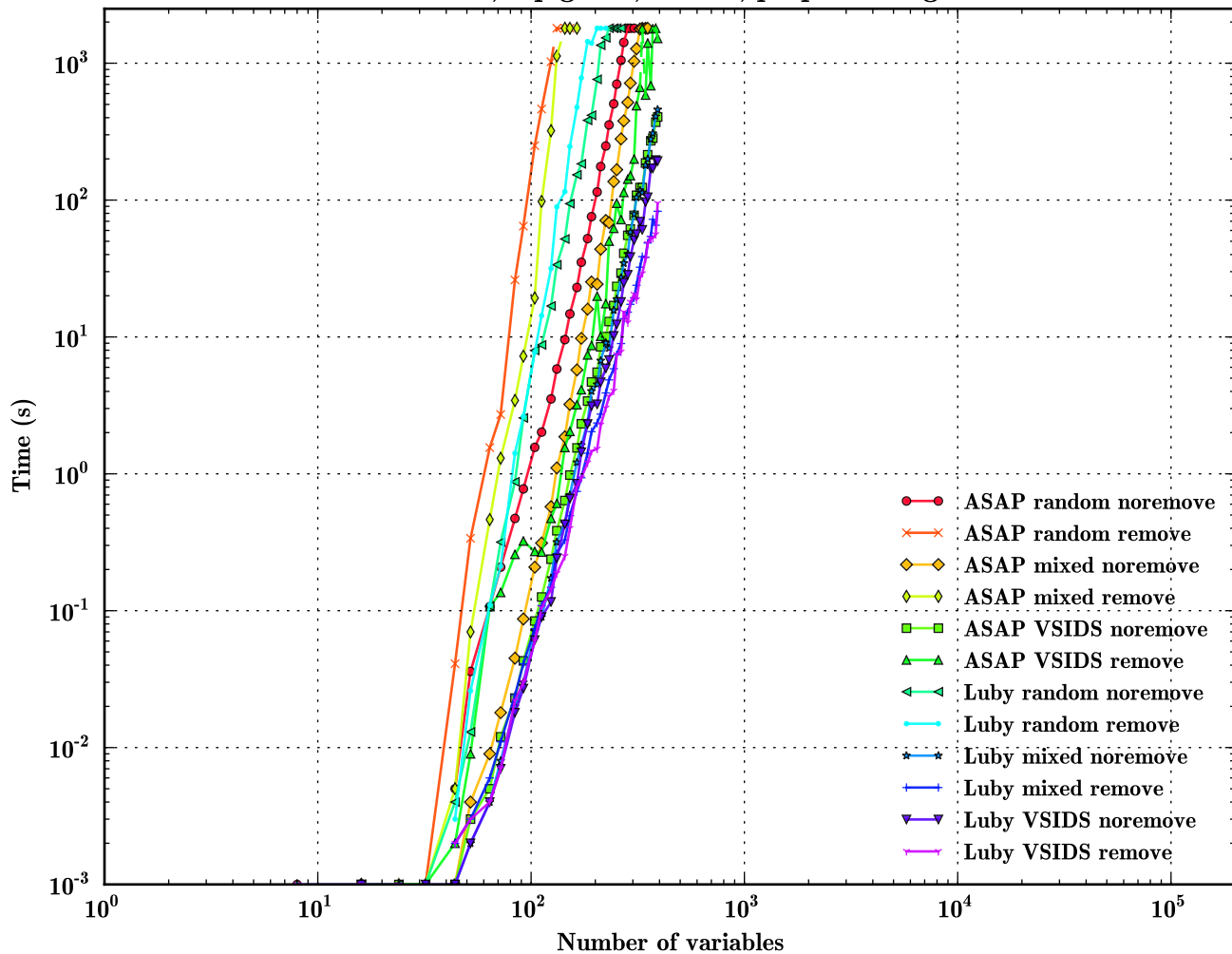




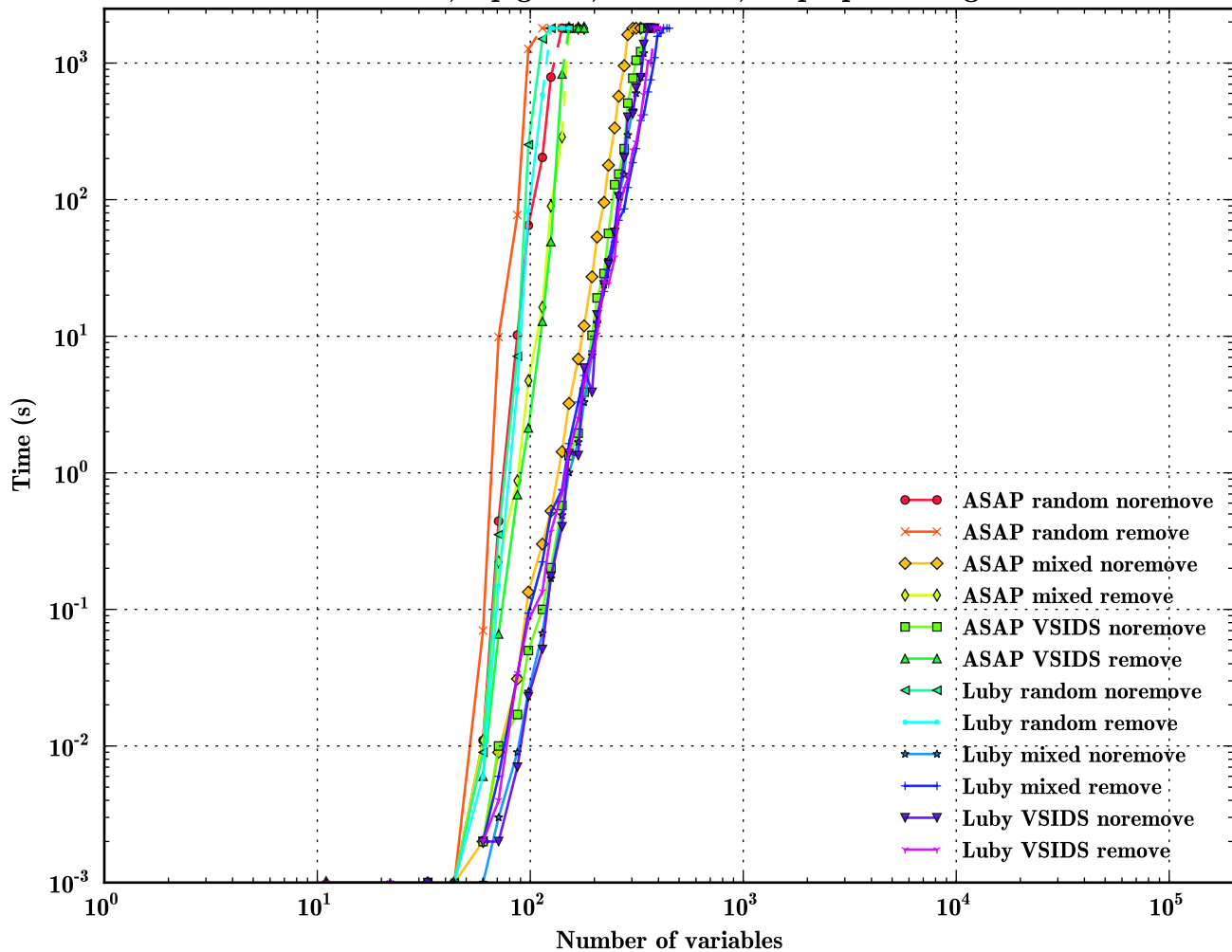
# RPHP, 4 pigeons, no shuffle, preprocessing



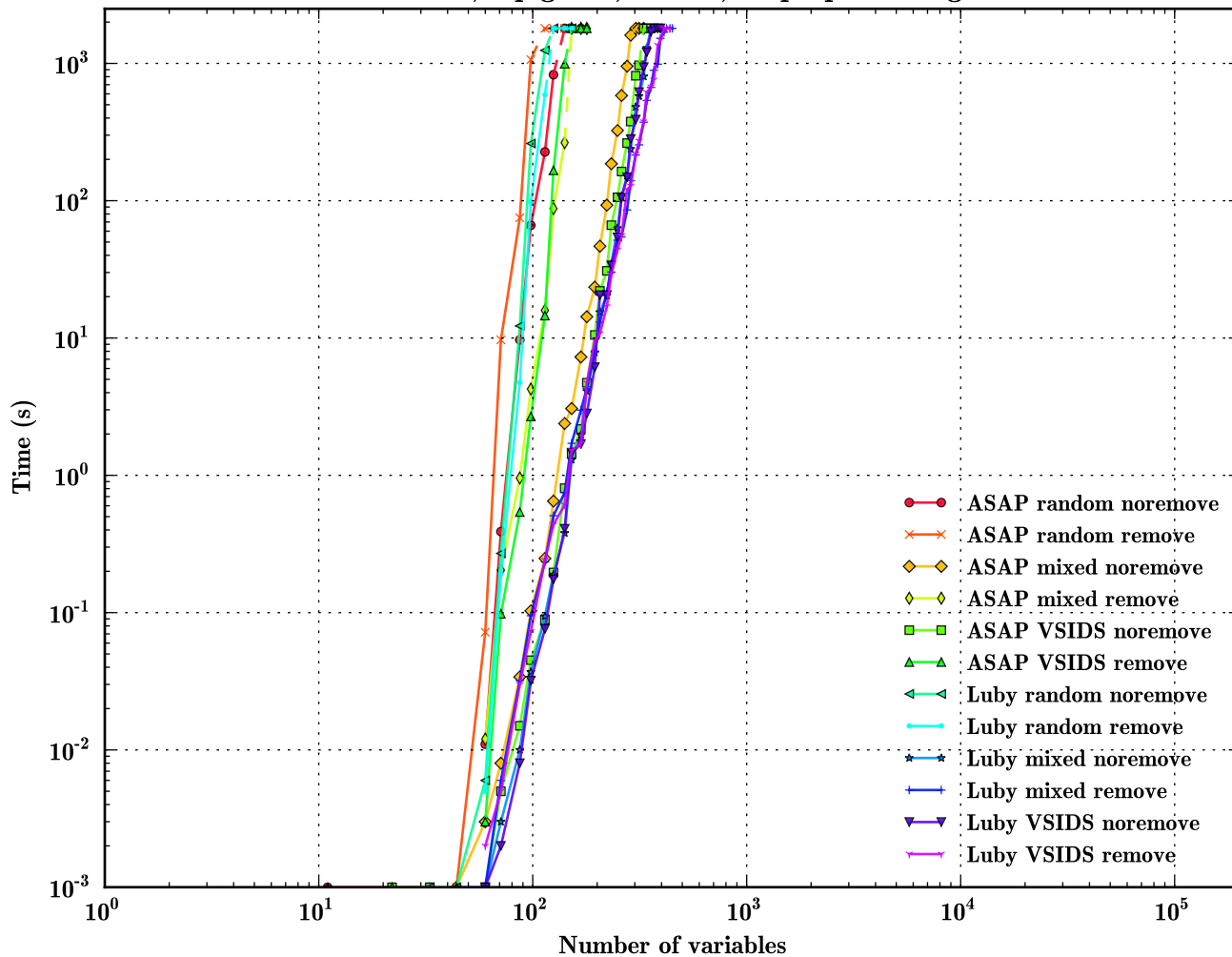
# RPHP, 4 pigeons, shuffle, preprocessing



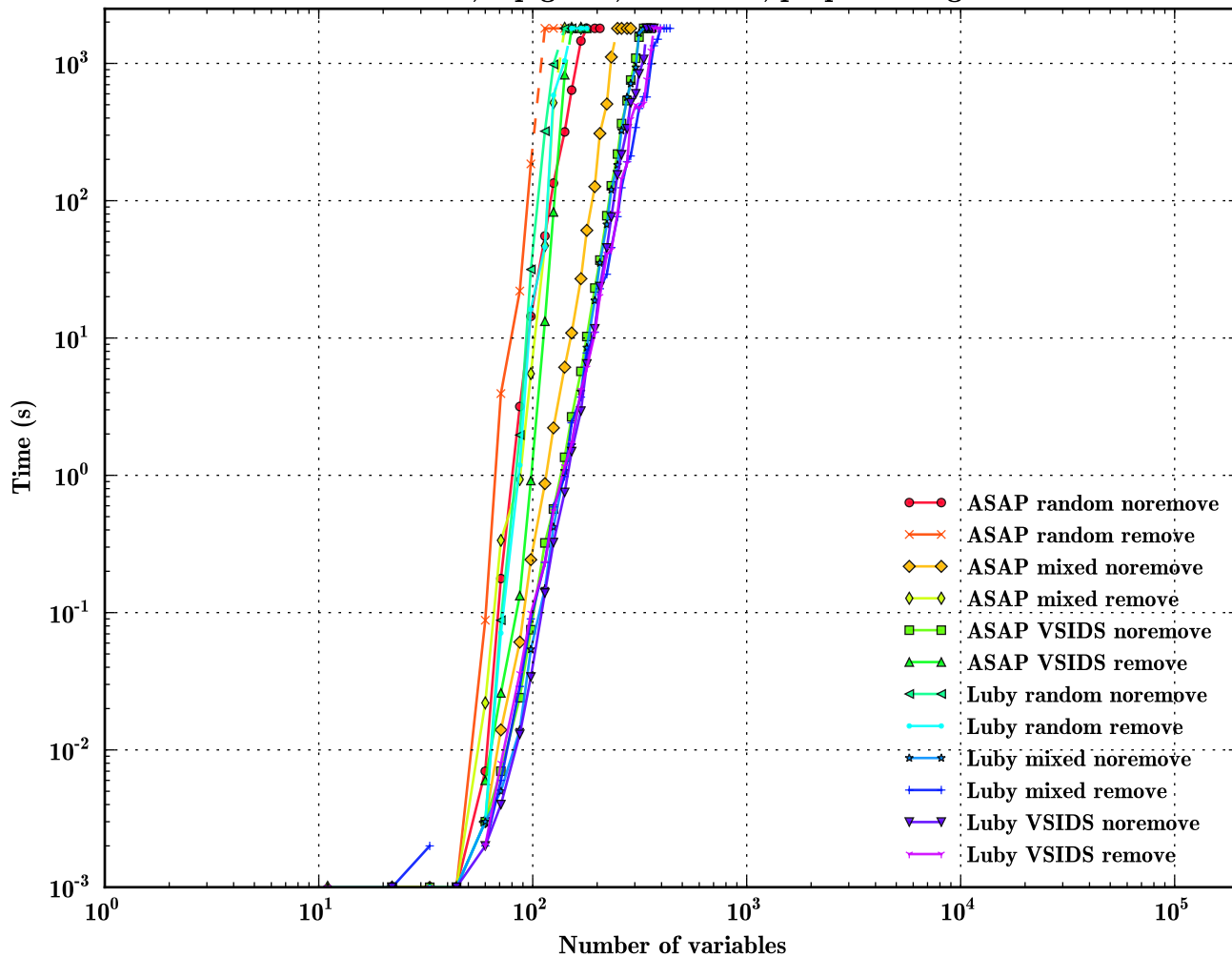
# RPHP, 5 pigeons, no shuffle, no preprocessing



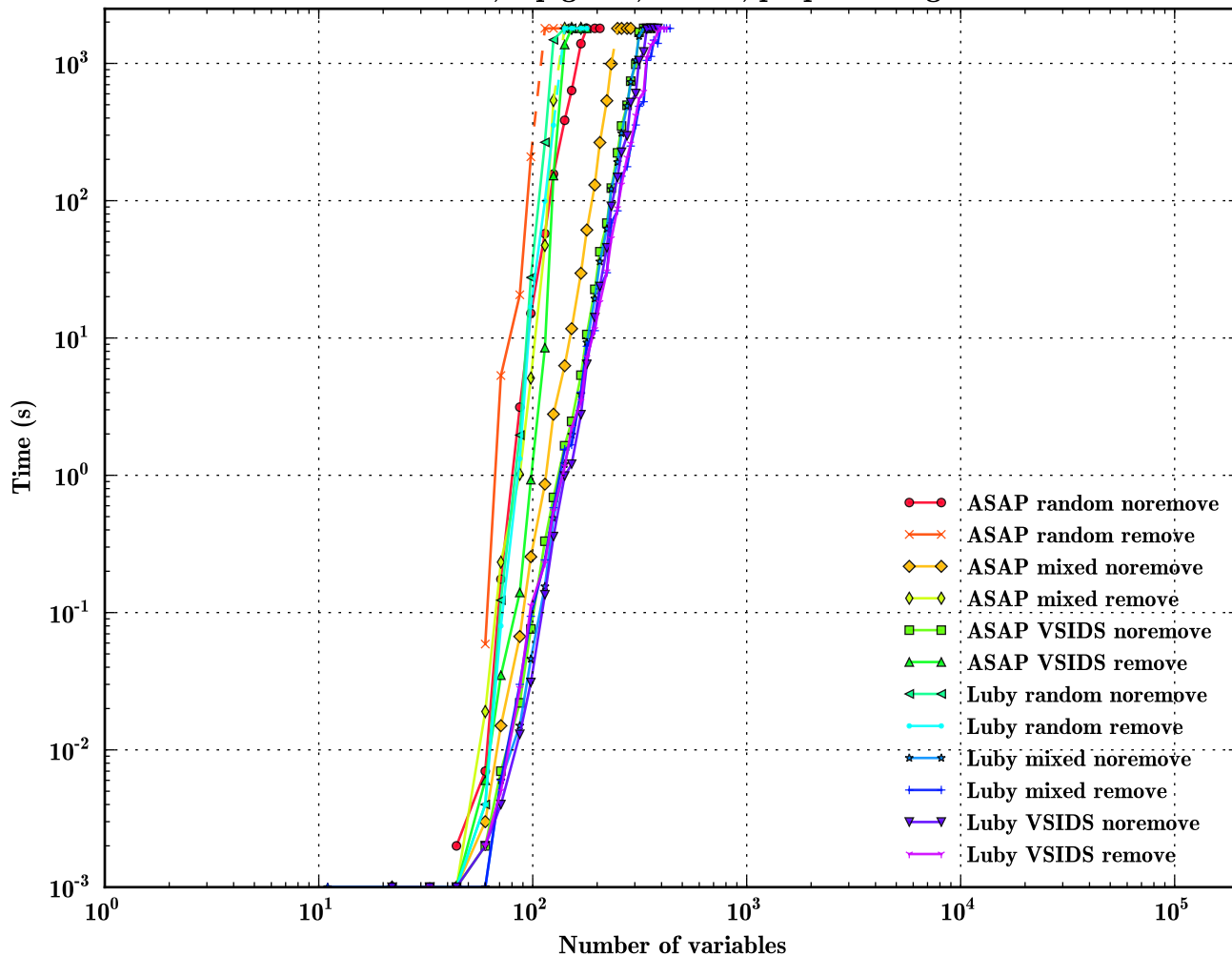
# RPHP, 5 pigeons, shuffle, no preprocessing



# RPHP, 5 pigeons, no shuffle, preprocessing

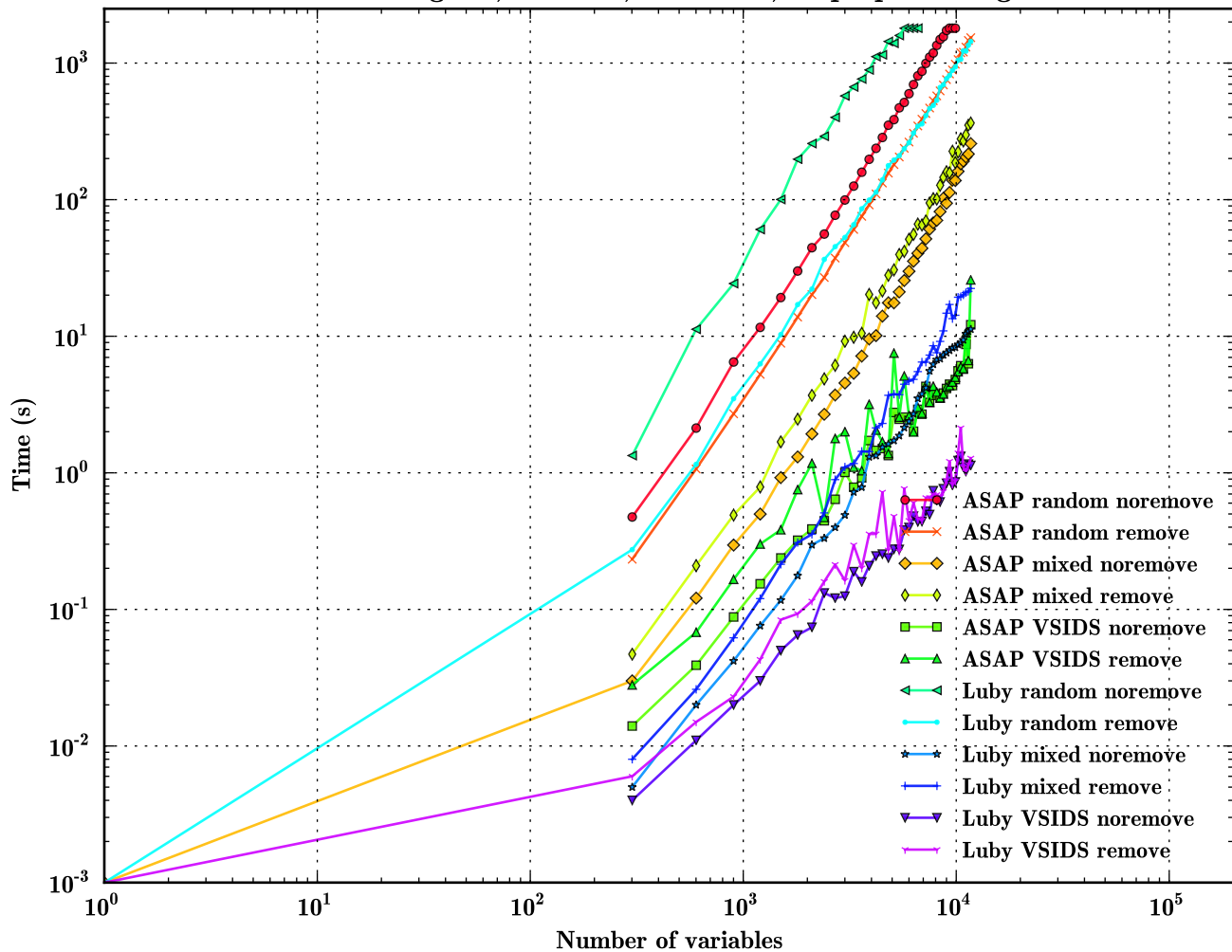


# RPHP, 5 pigeons, shuffle, preprocessing



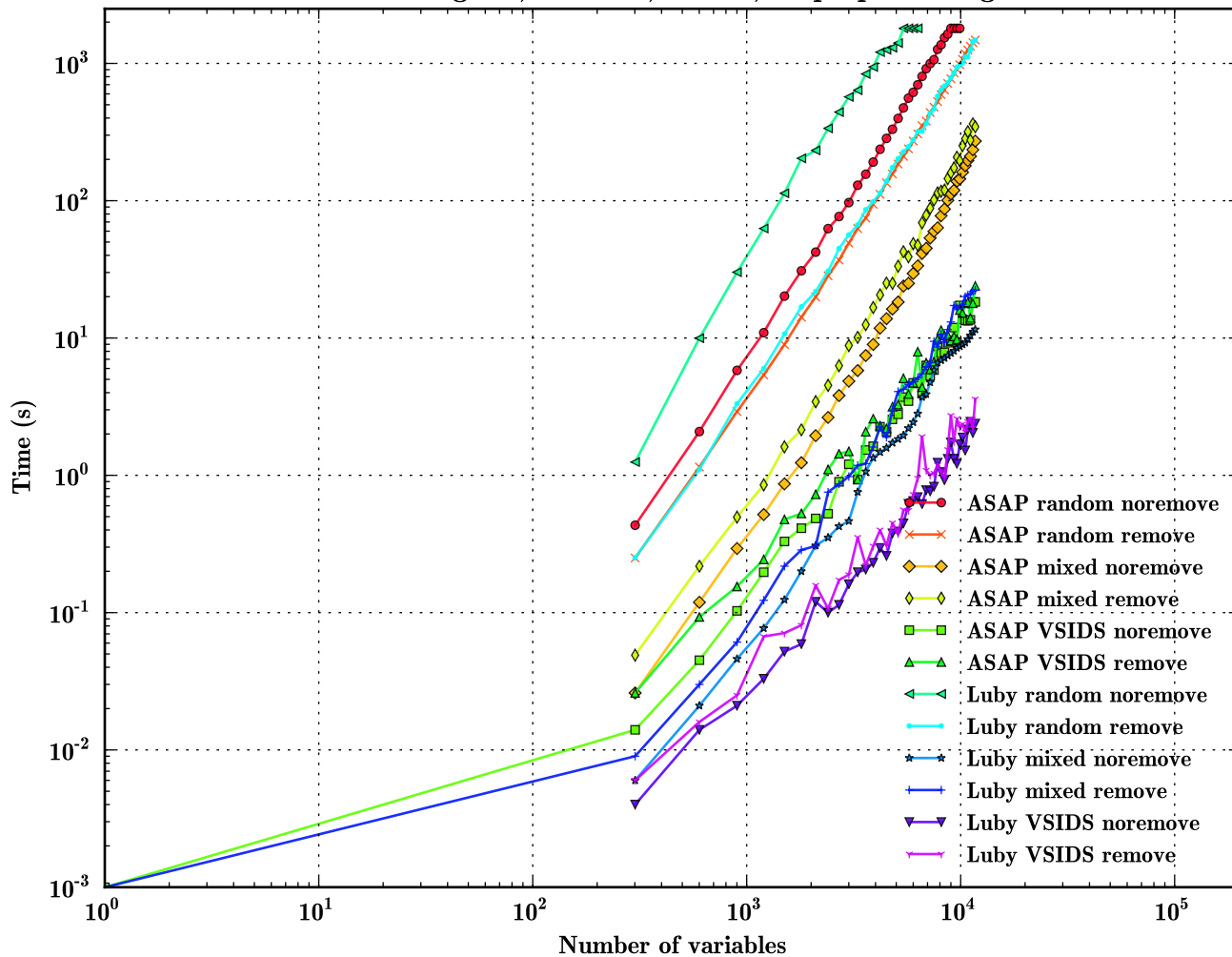
# Tseitin grids

Tseitin grids, width: 2, no shuffle, no preprocessing

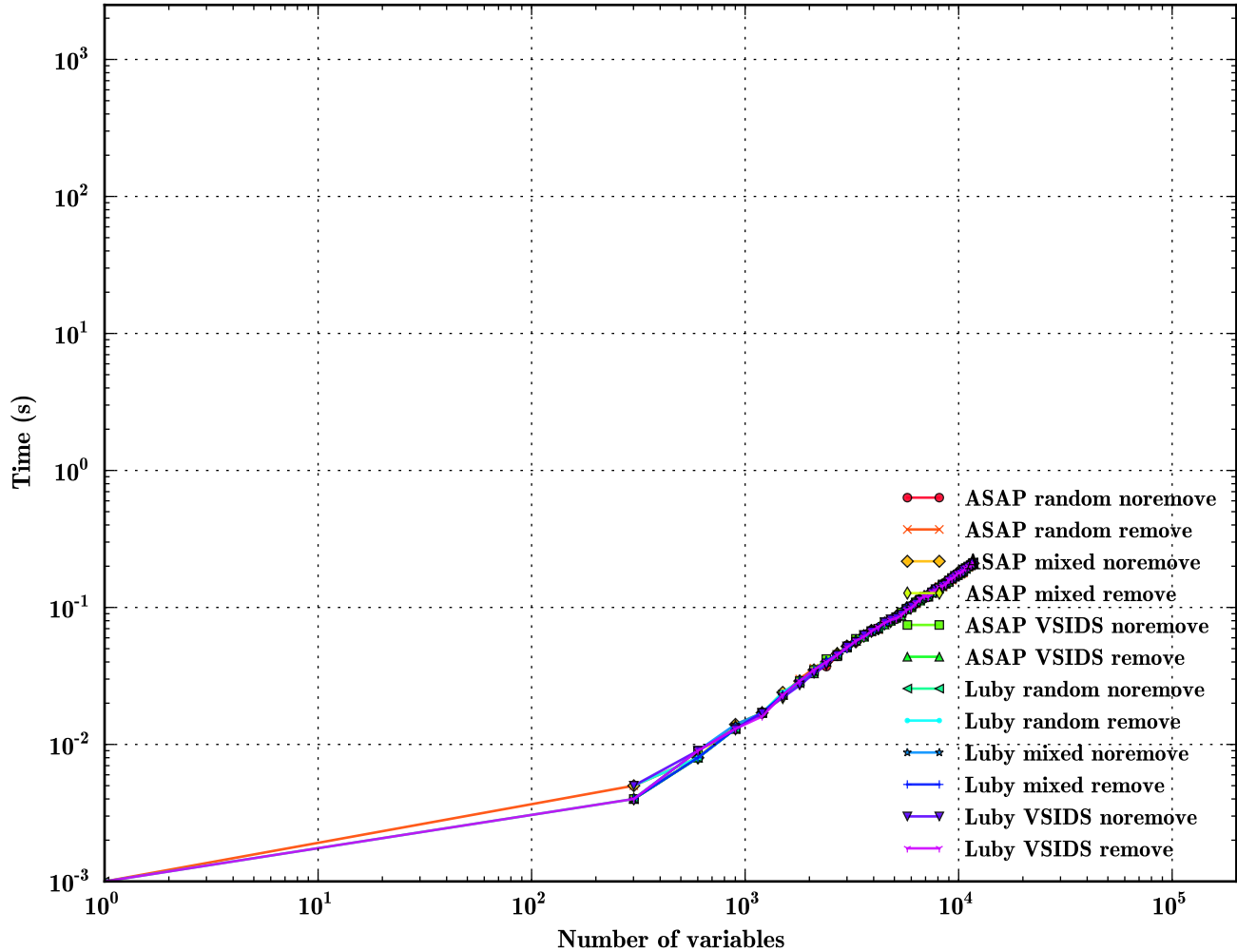




Tseitin grids, width: 2, shuffle, no preprocessing

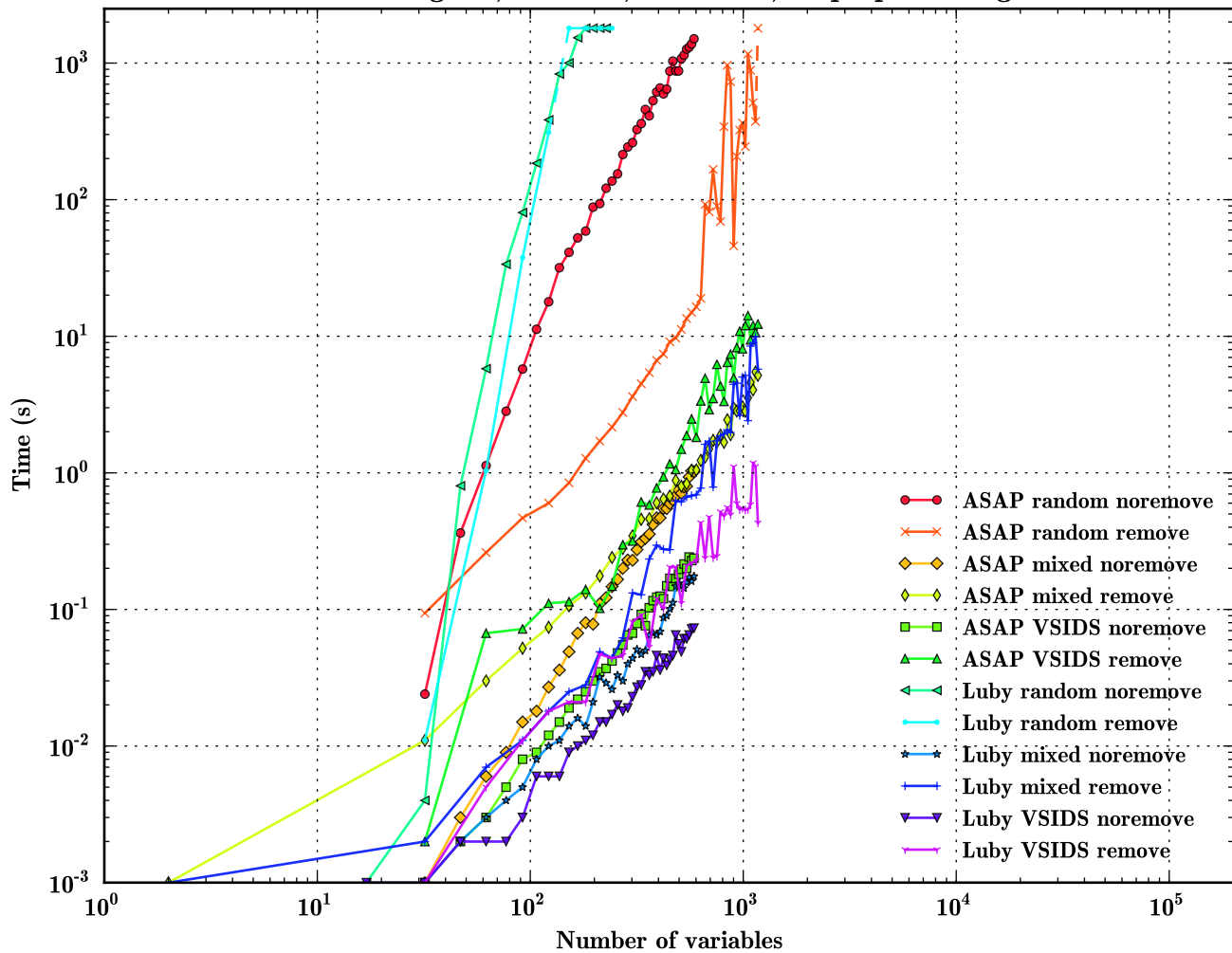


Tseitlin grids, width: 2, no shuffle, preprocessing

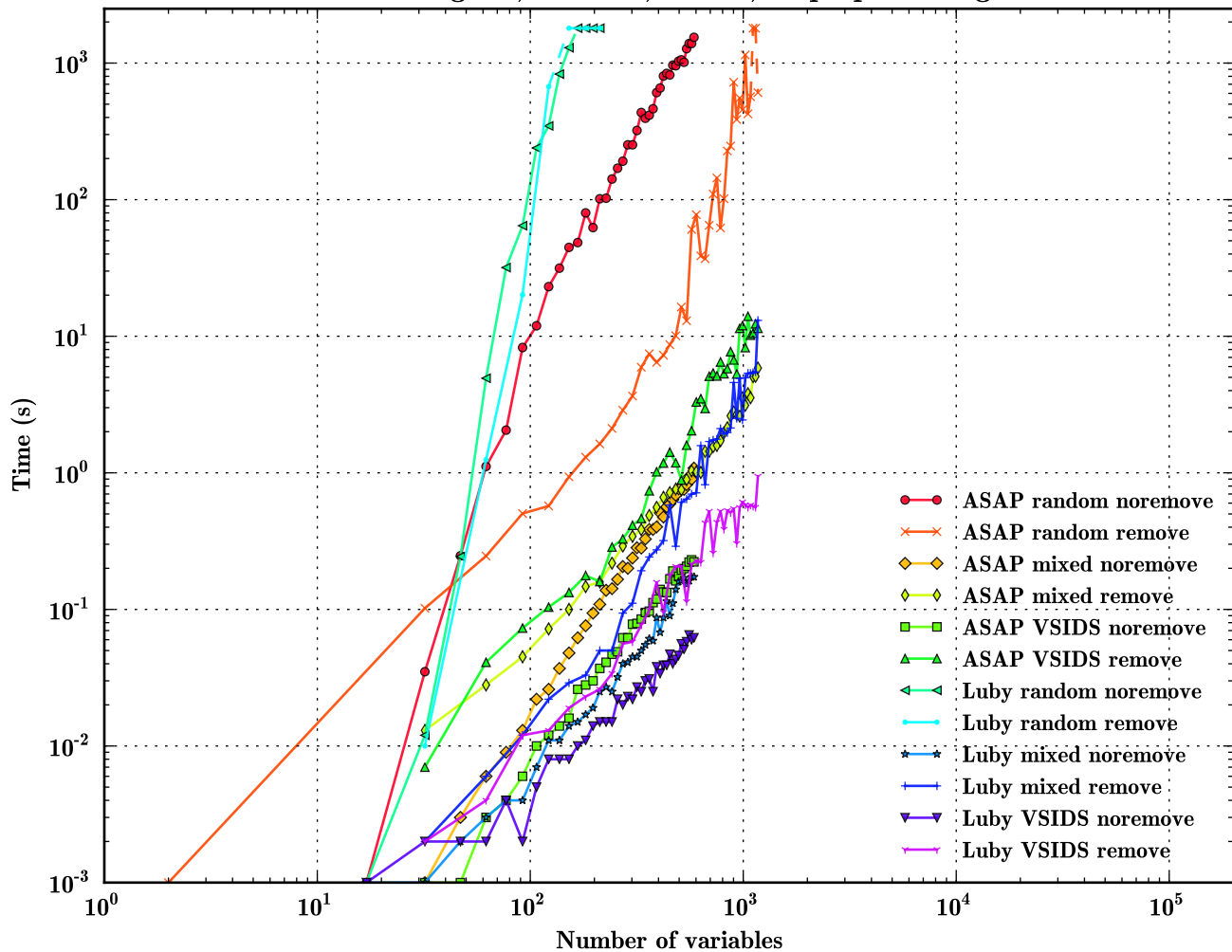




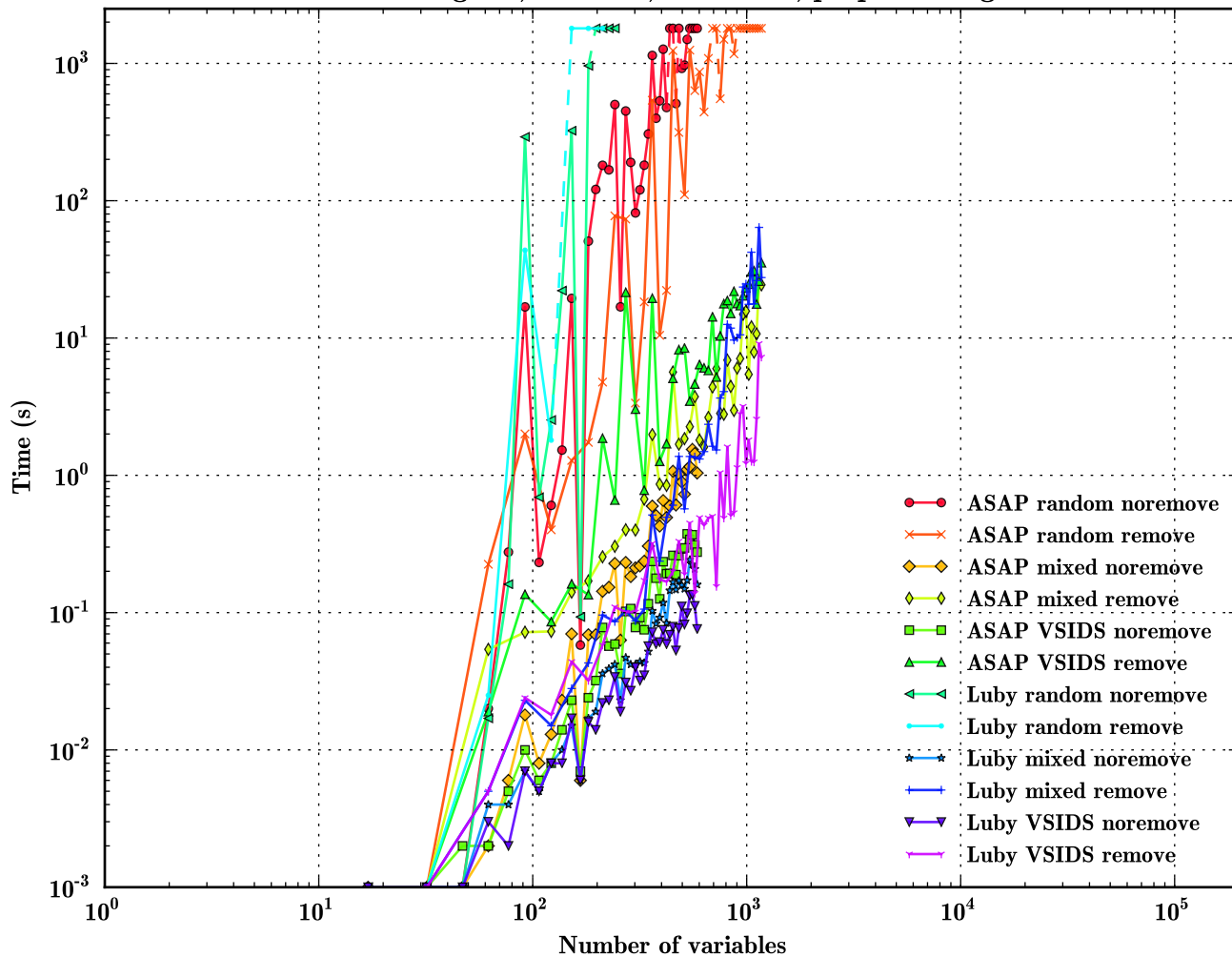
Tseitin grids, width: 3, no shuffle, no preprocessing



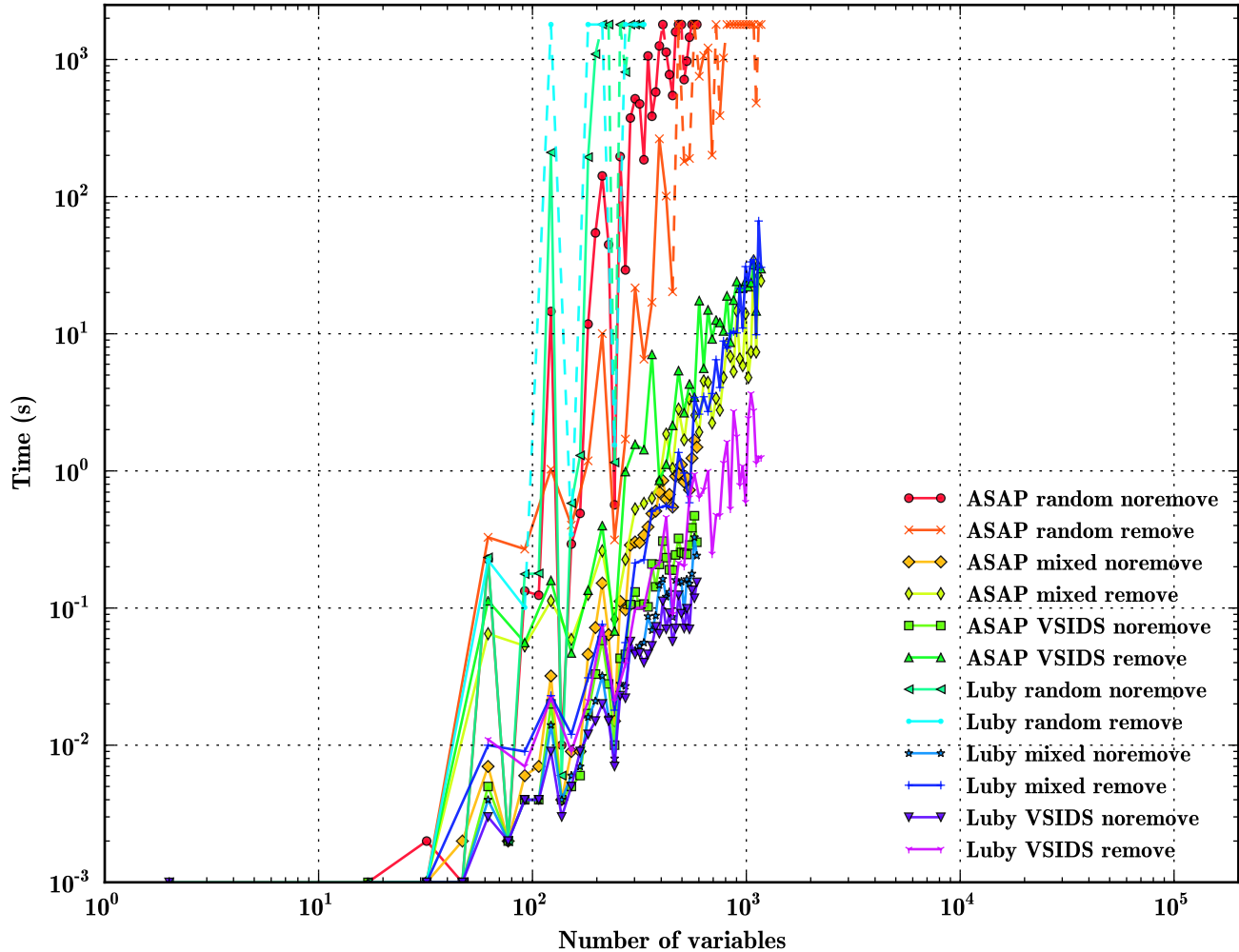
Tseitin grids, width: 3, shuffle, no preprocessing



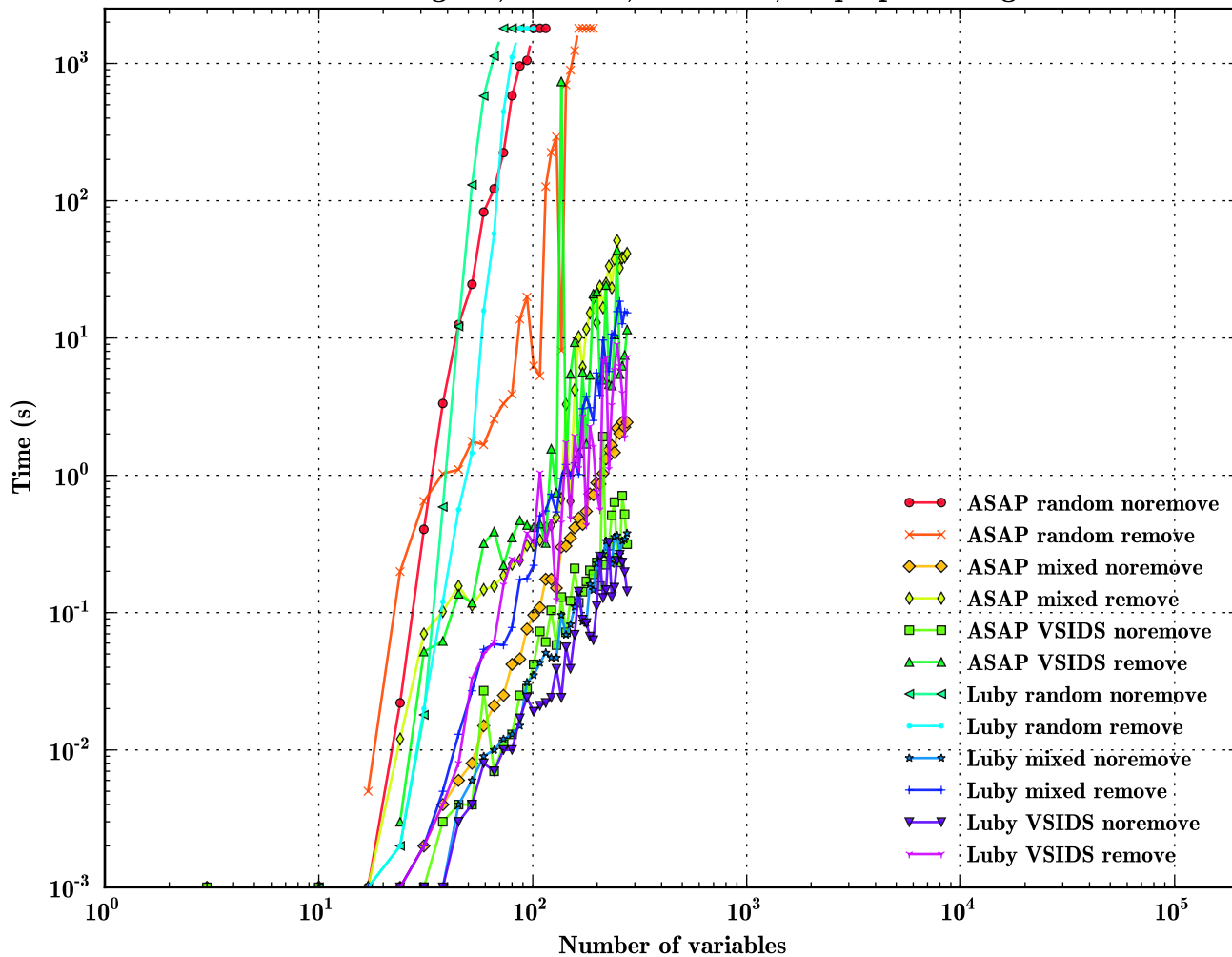
Tseitin grids, width: 3, no shuffle, preprocessing



Tseitin grids, width: 3, shuffle, preprocessing

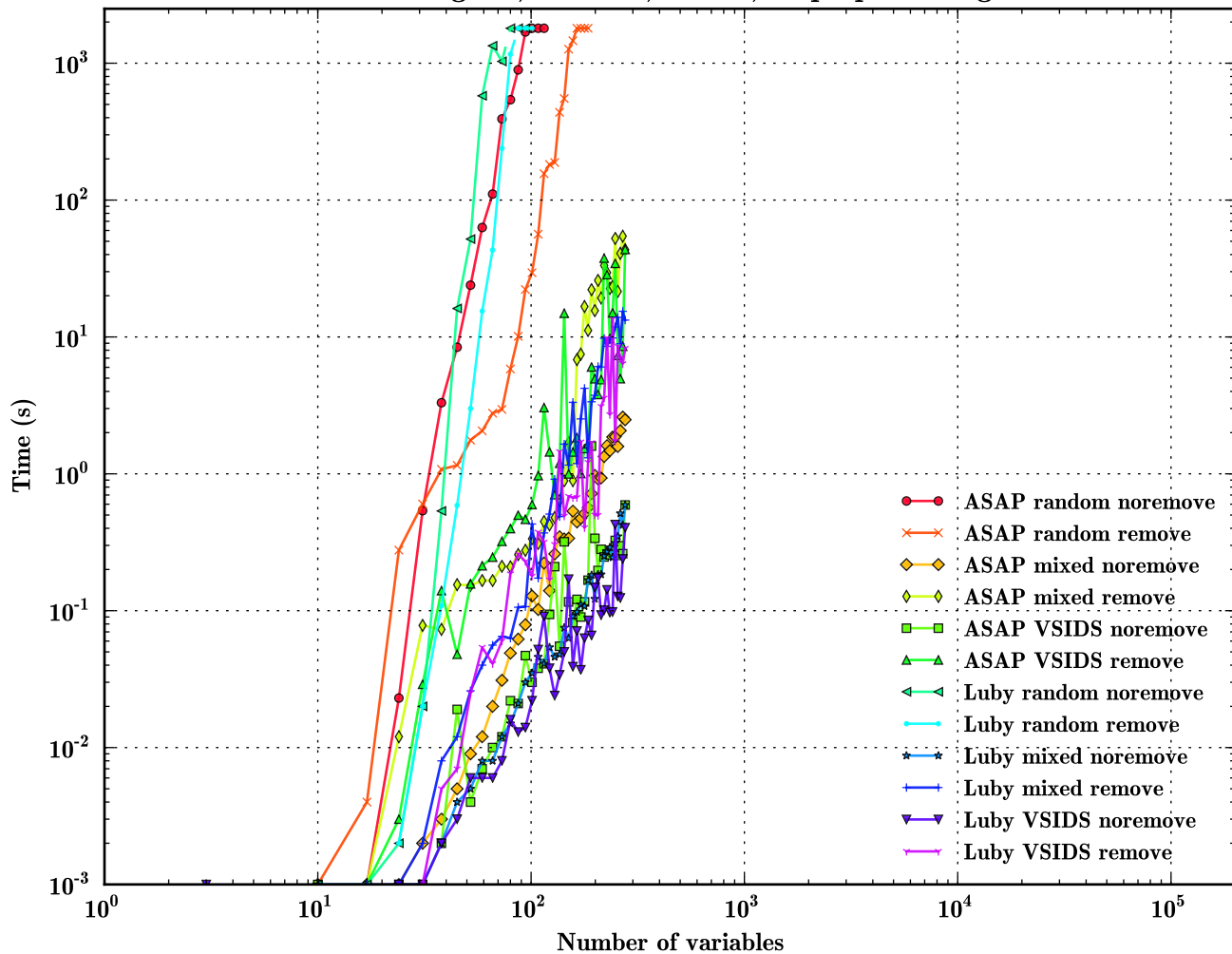


Tseitin grids, width: 4, no shuffle, no preprocessing

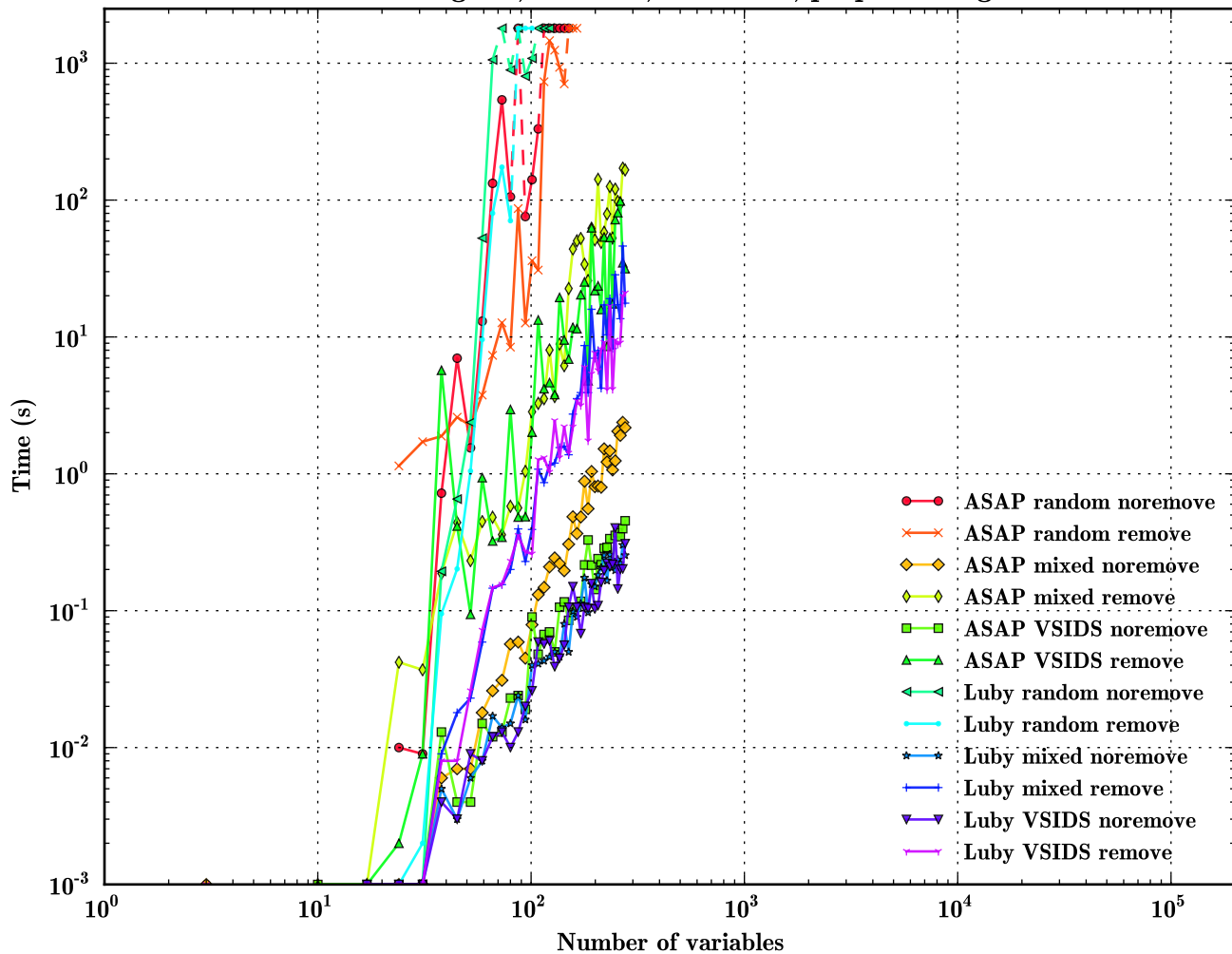




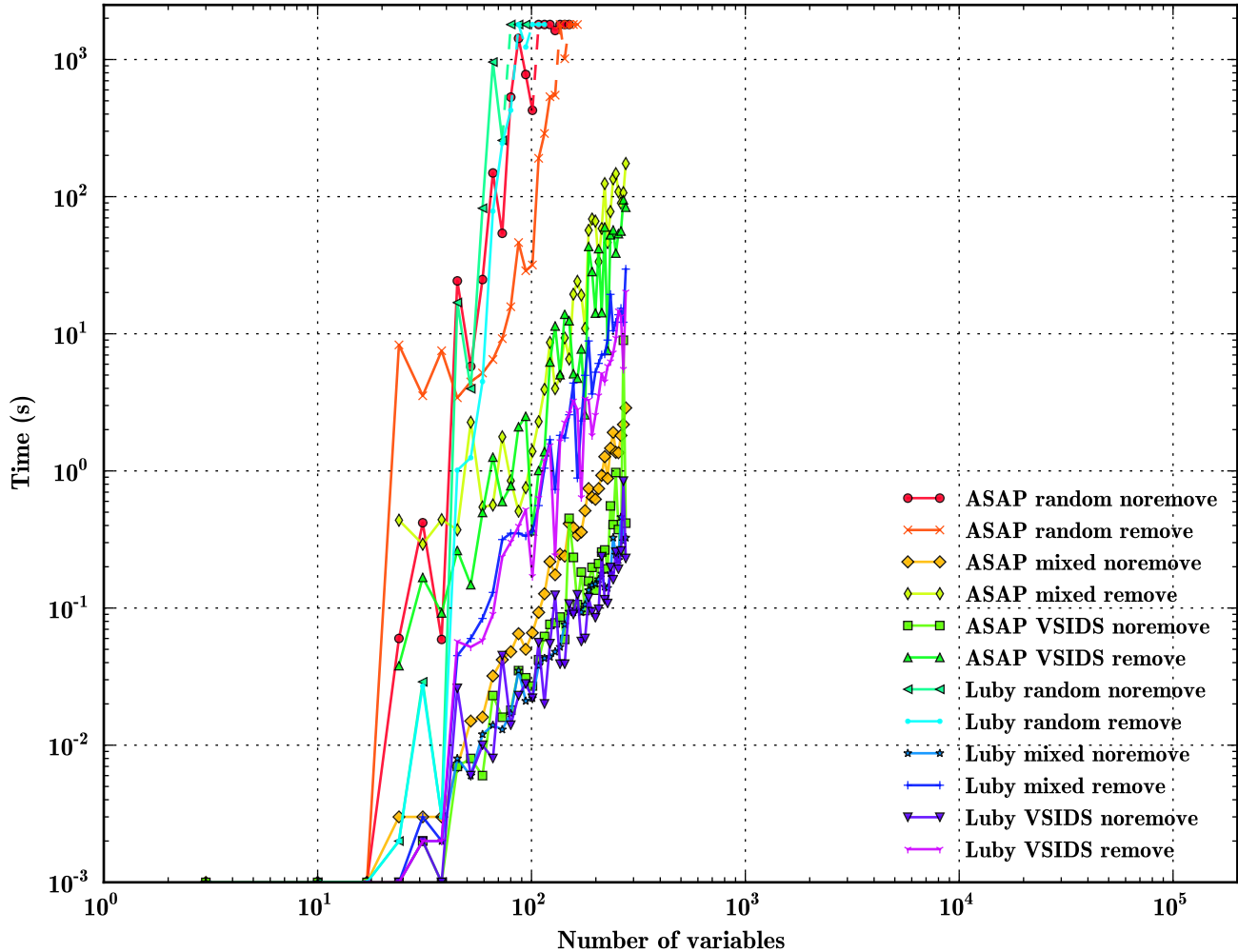
Tseitin grids, width: 4, shuffle, no preprocessing



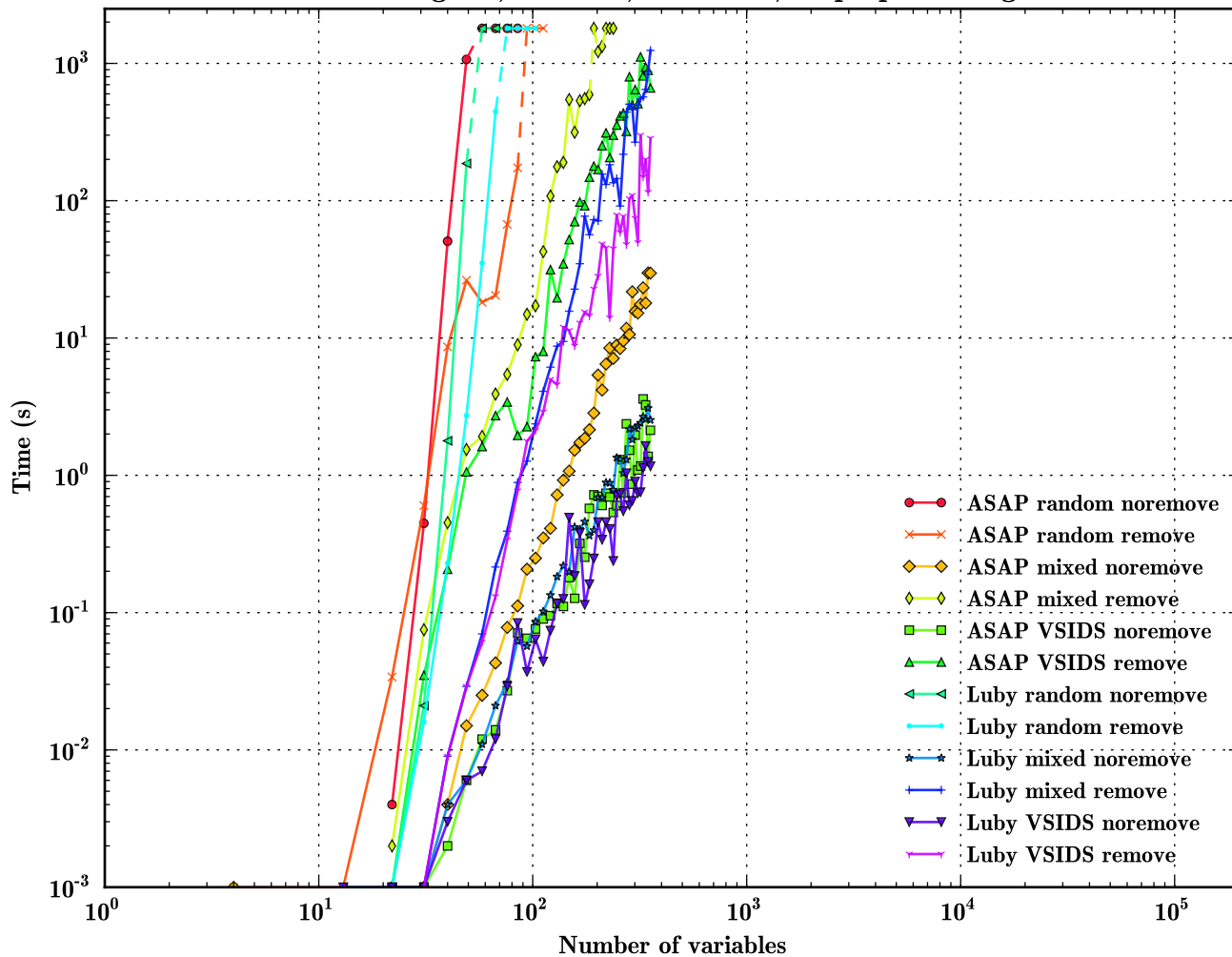
Tseitlin grids, width: 4, no shuffle, preprocessing



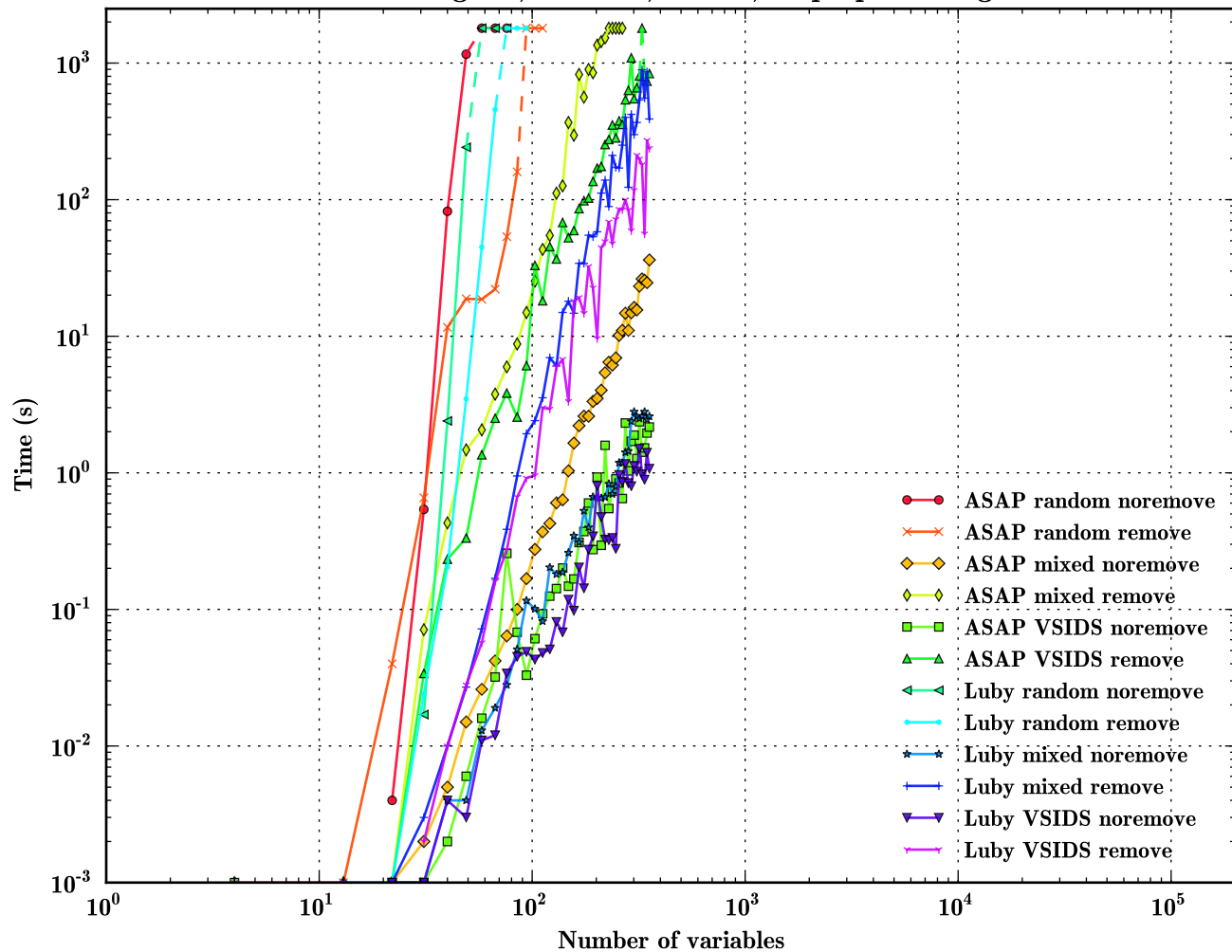
Tseitin grids, width: 4, shuffle, preprocessing



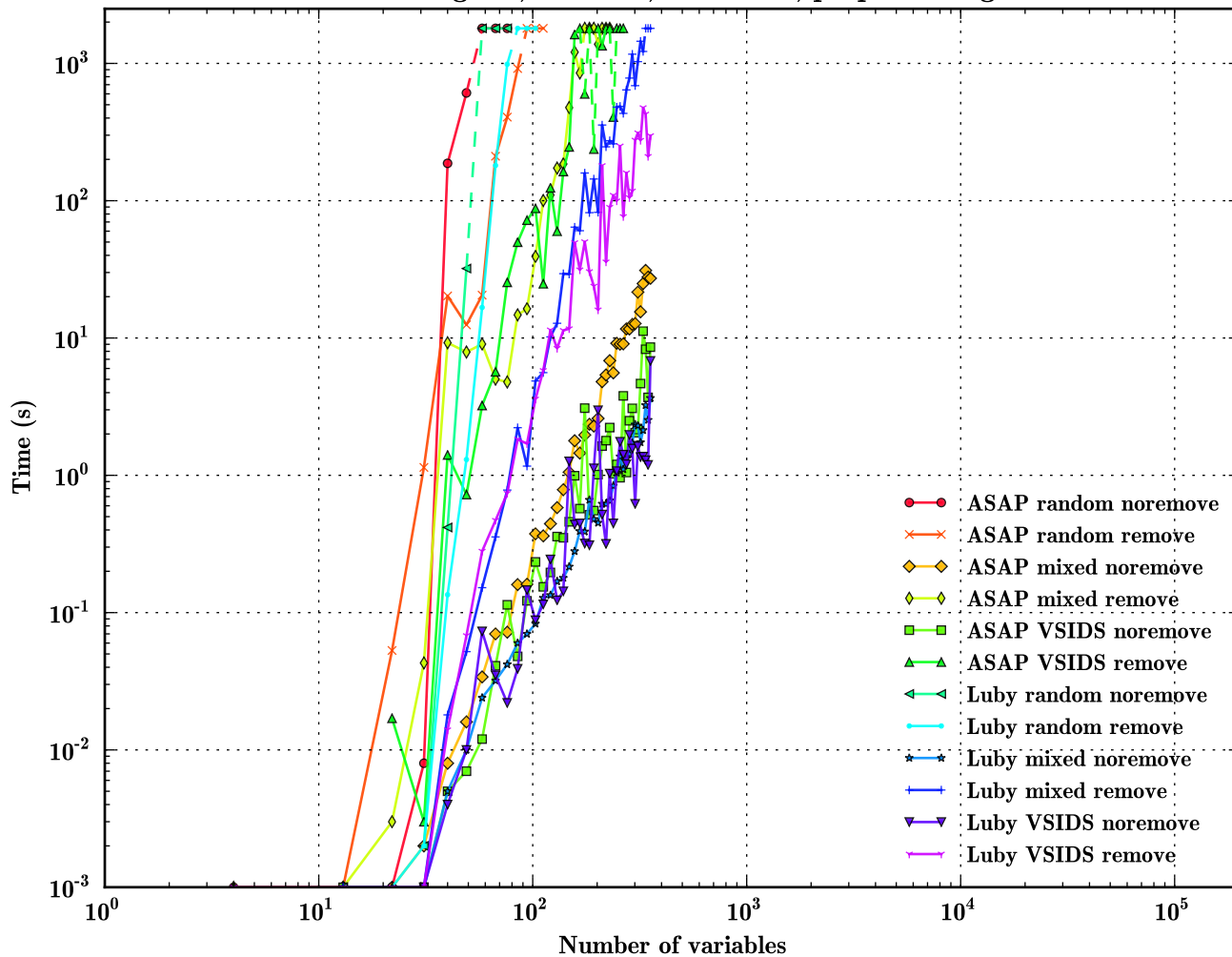
Tseitin grids, width: 5, no shuffle, no preprocessing



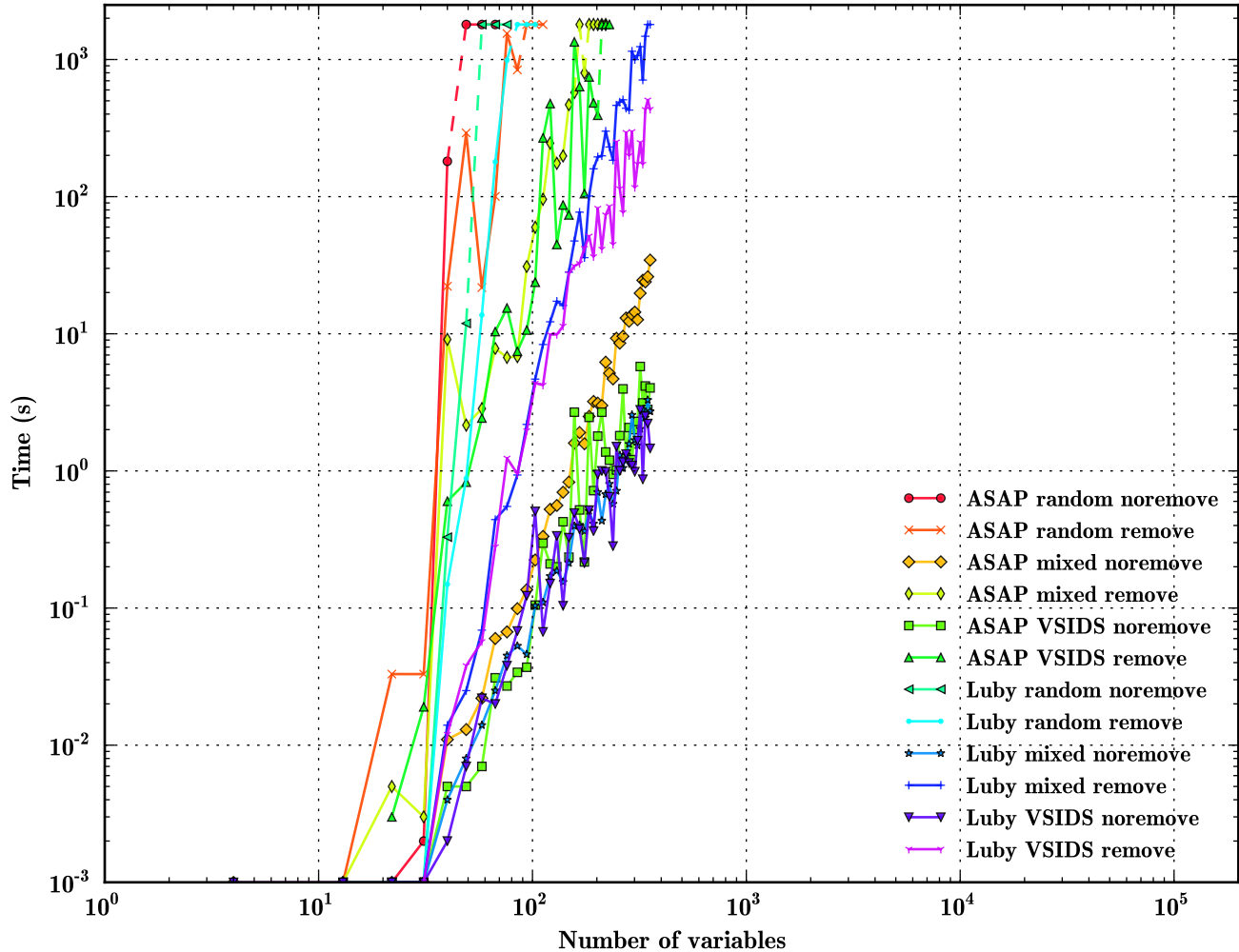
Tseitin grids, width: 5, shuffle, no preprocessing



Tseitin grids, width: 5, no shuffle, preprocessing



Tseitin grids, width: 5, shuffle, preprocessing

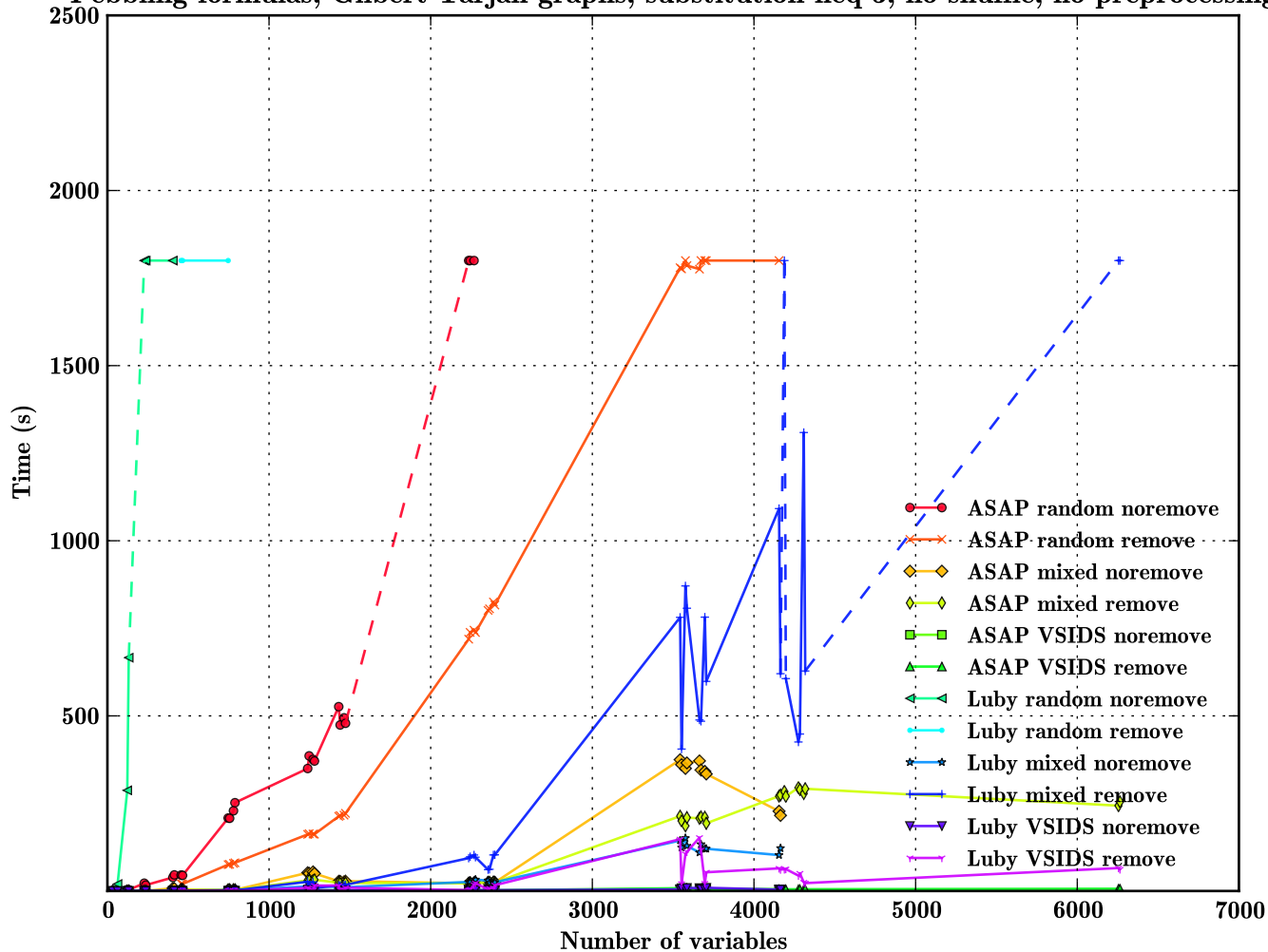


**CPU time**  
**linlin scale**

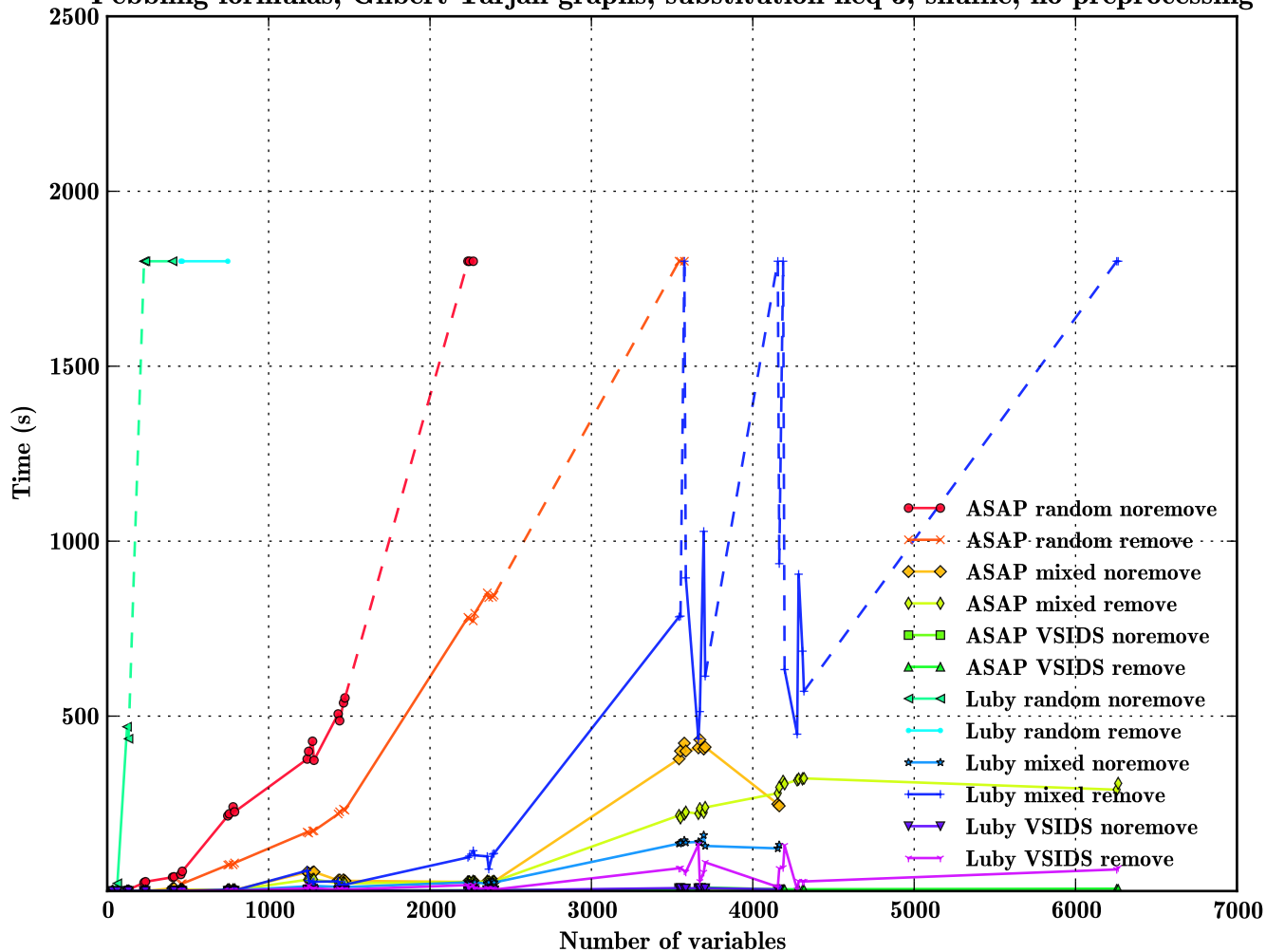


**Pebbling formulas with  
substitution neq(not all equal)  
of arity 3**

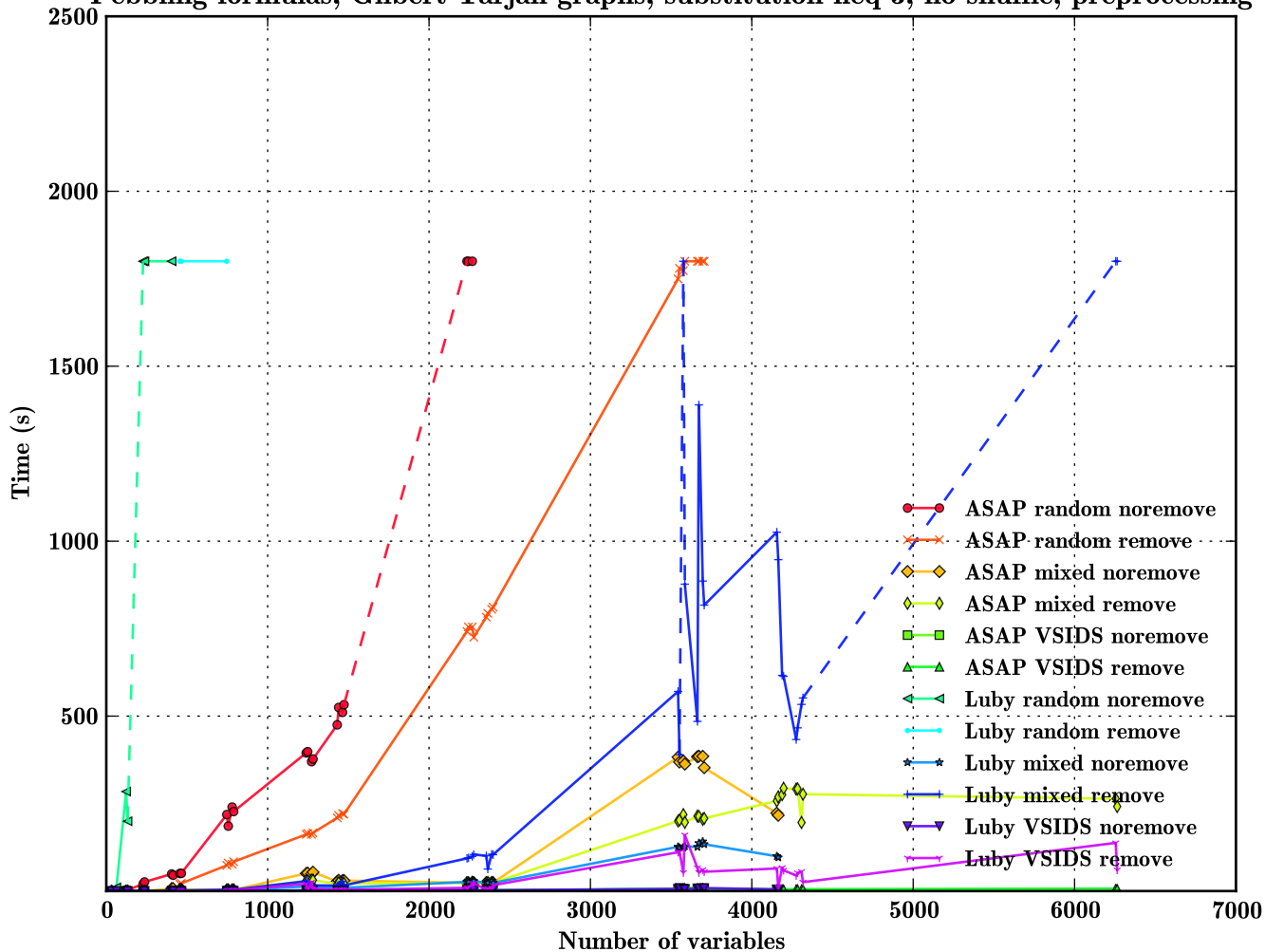
Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, no preprocessing



Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, no preprocessing

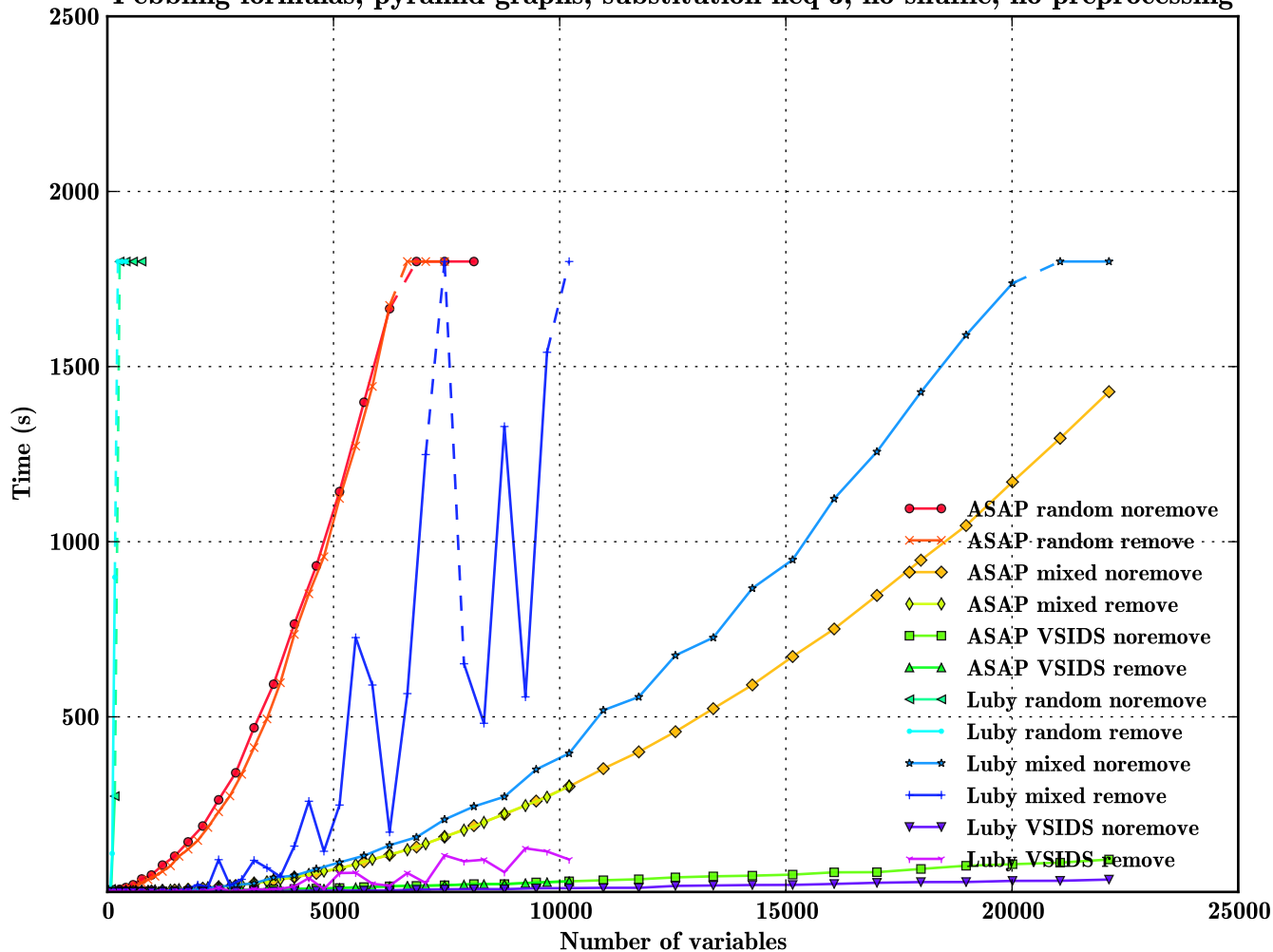


Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, preprocessing



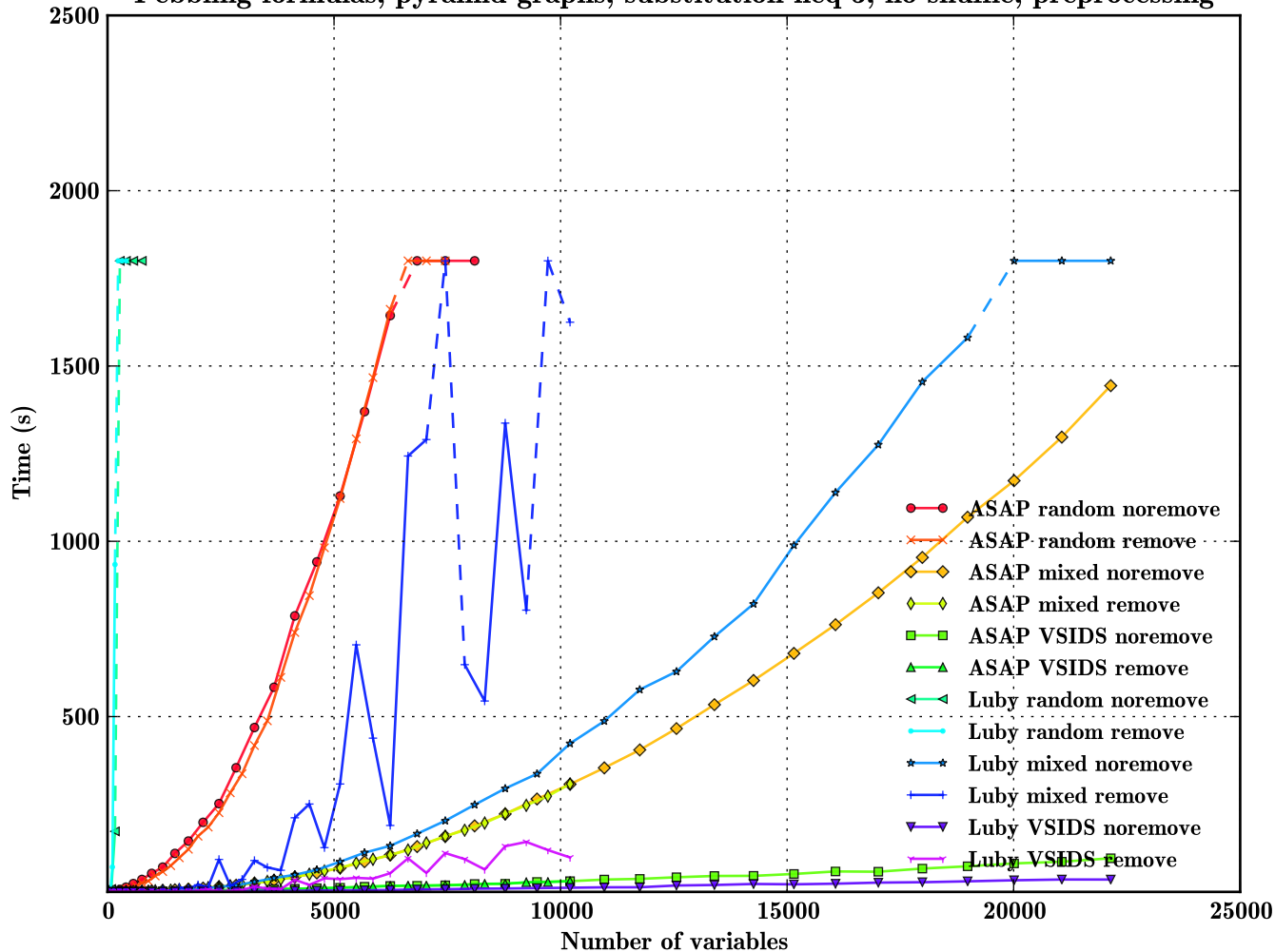


Pebbling formulas, pyramid graphs, substitution neq 3, no shuffle, no preprocessing





Pebbling formulas, pyramid graphs, substitution neq 3, no shuffle, preprocessing

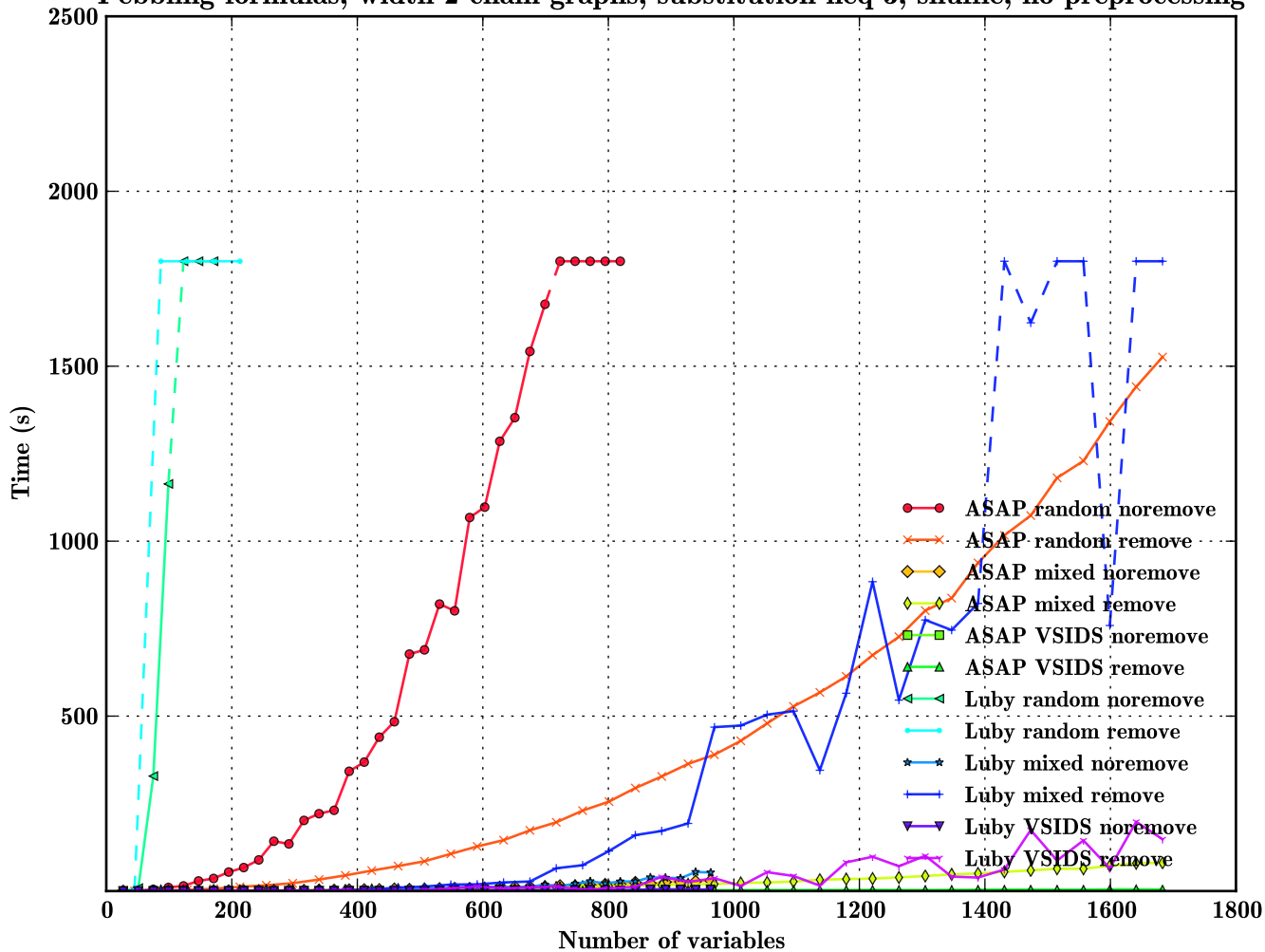




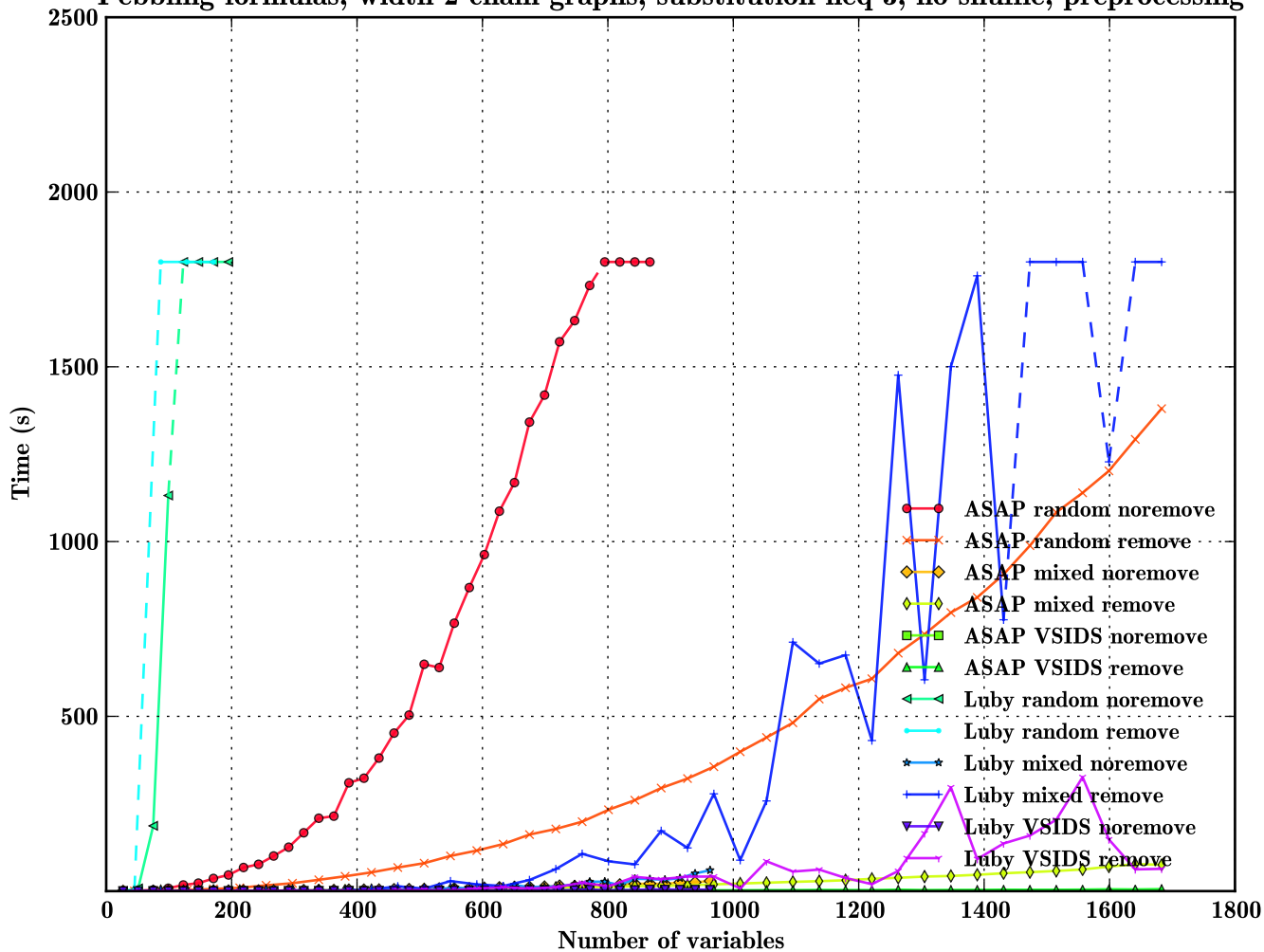




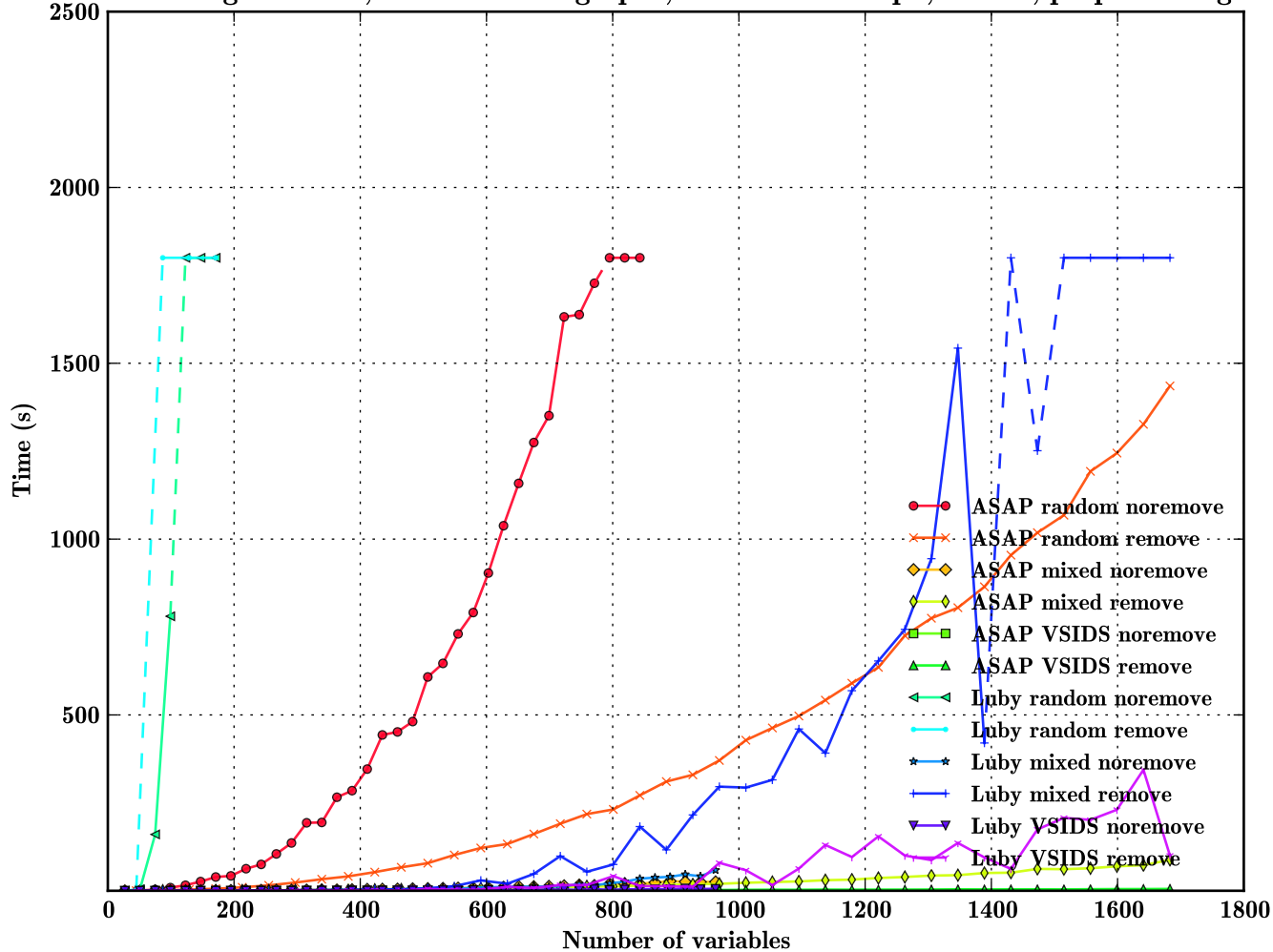
Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, no preprocessing



Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, preprocessing

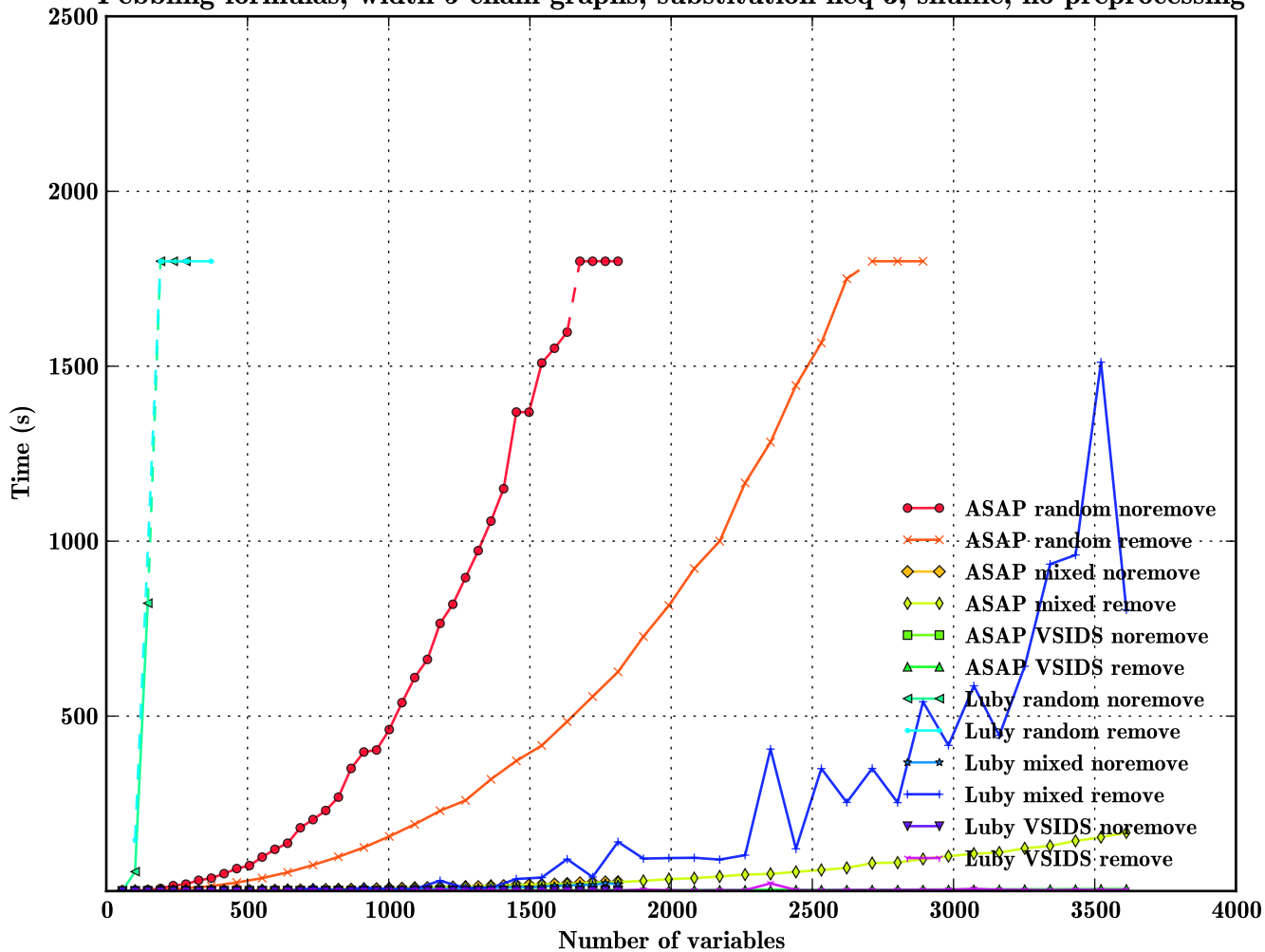


Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, preprocessing

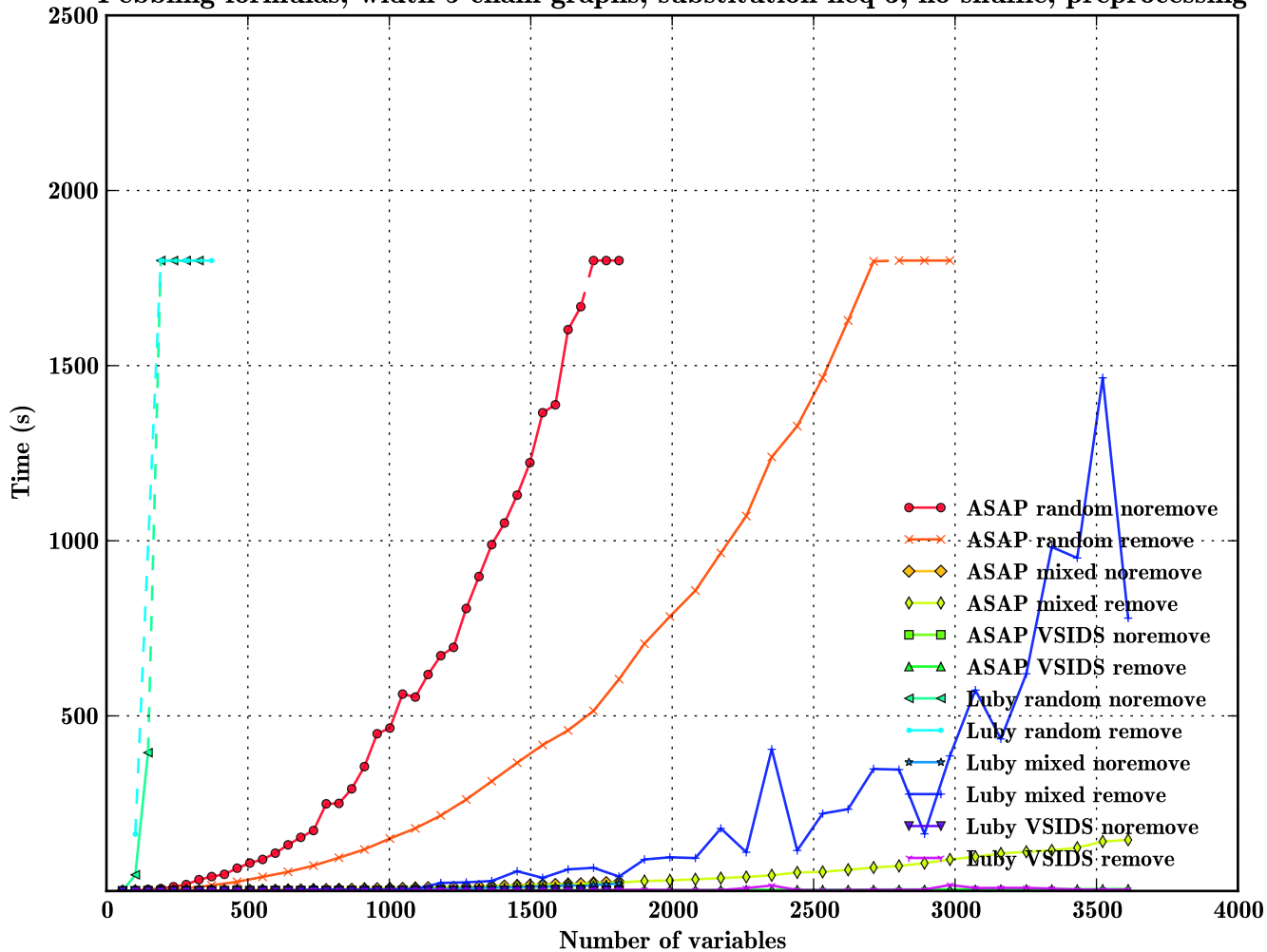




Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, no preprocessing

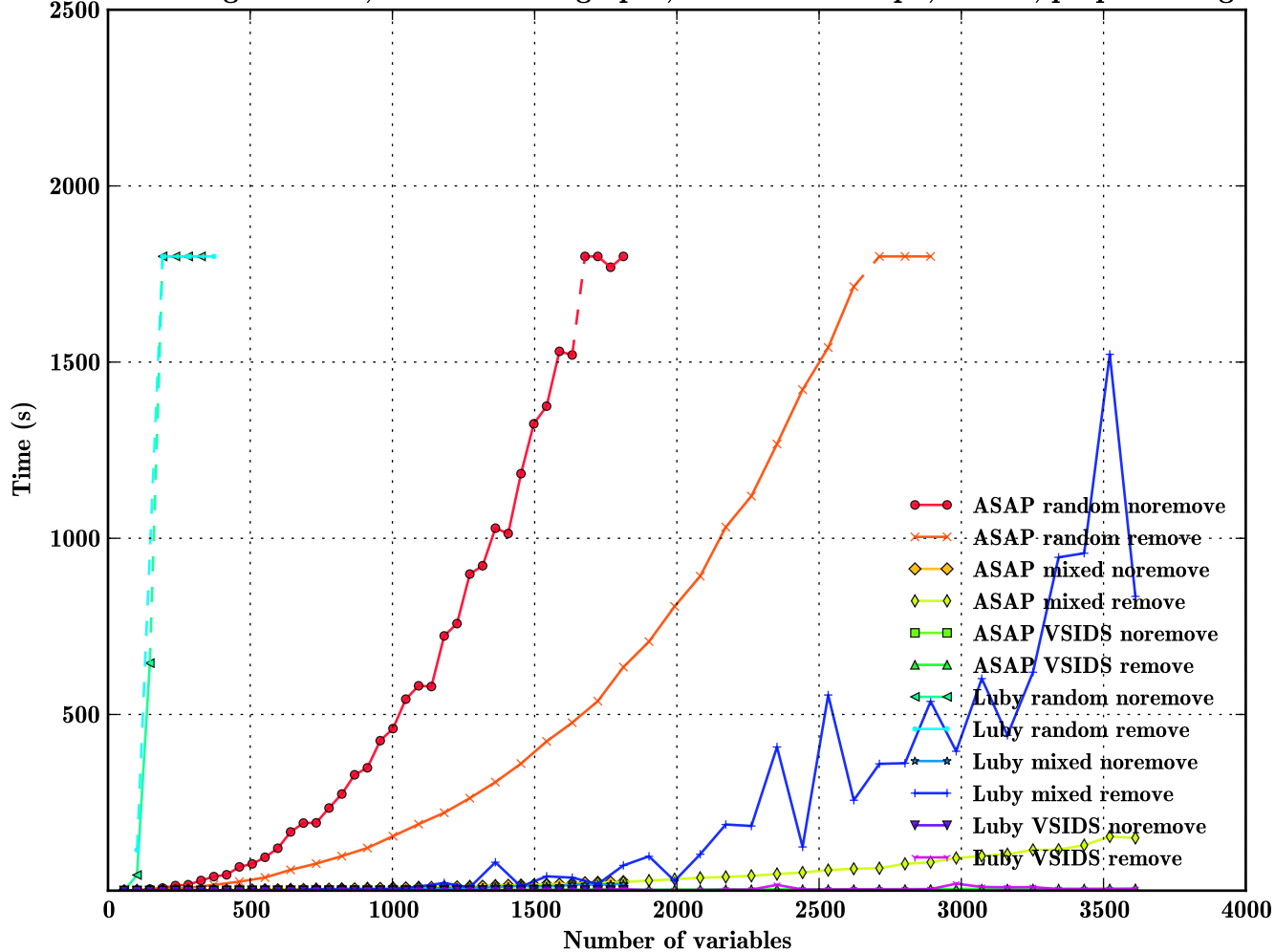


Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, preprocessing



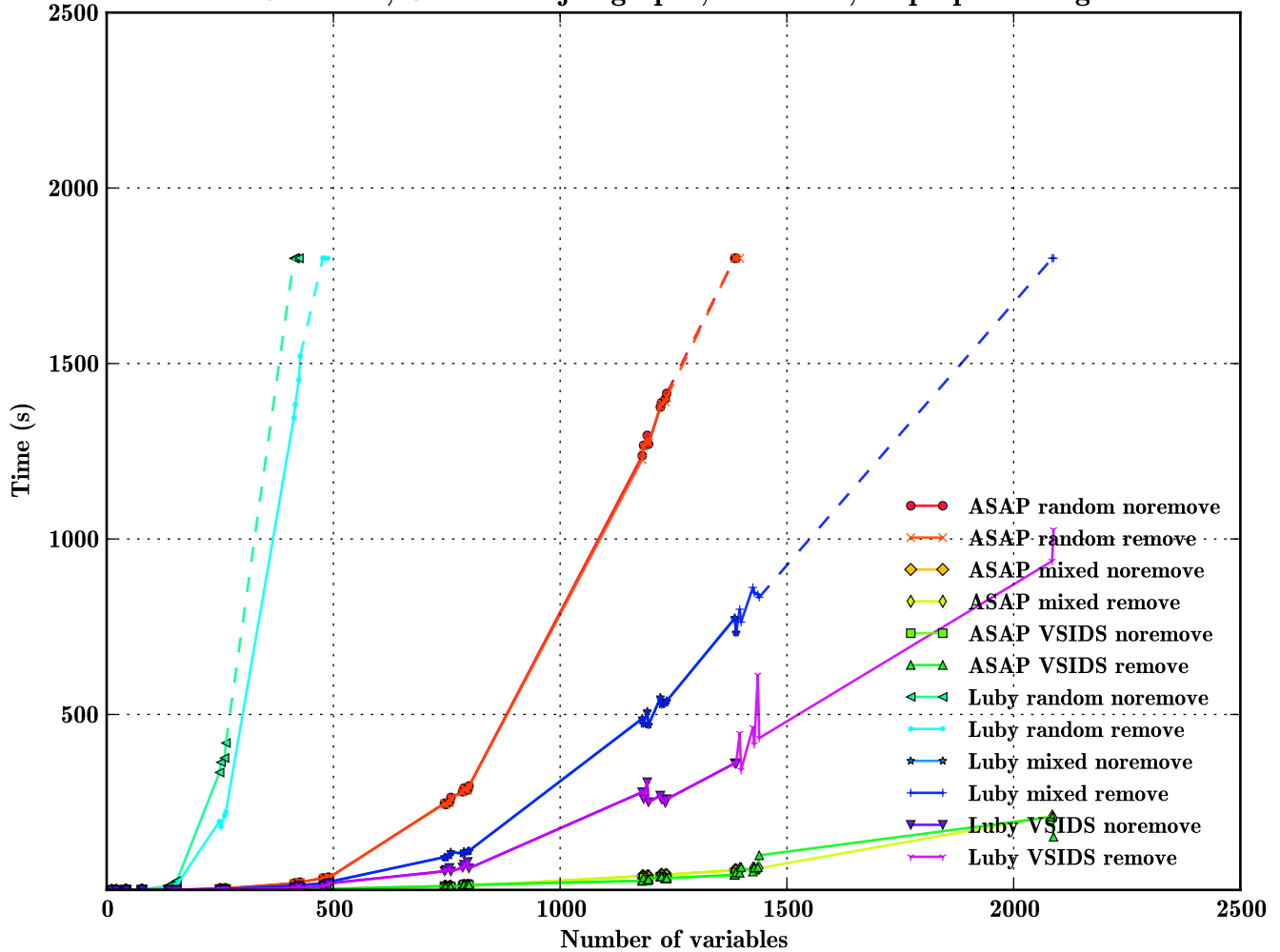


Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, preprocessing



# **Cartesian products of vanilla pebbling formulas**

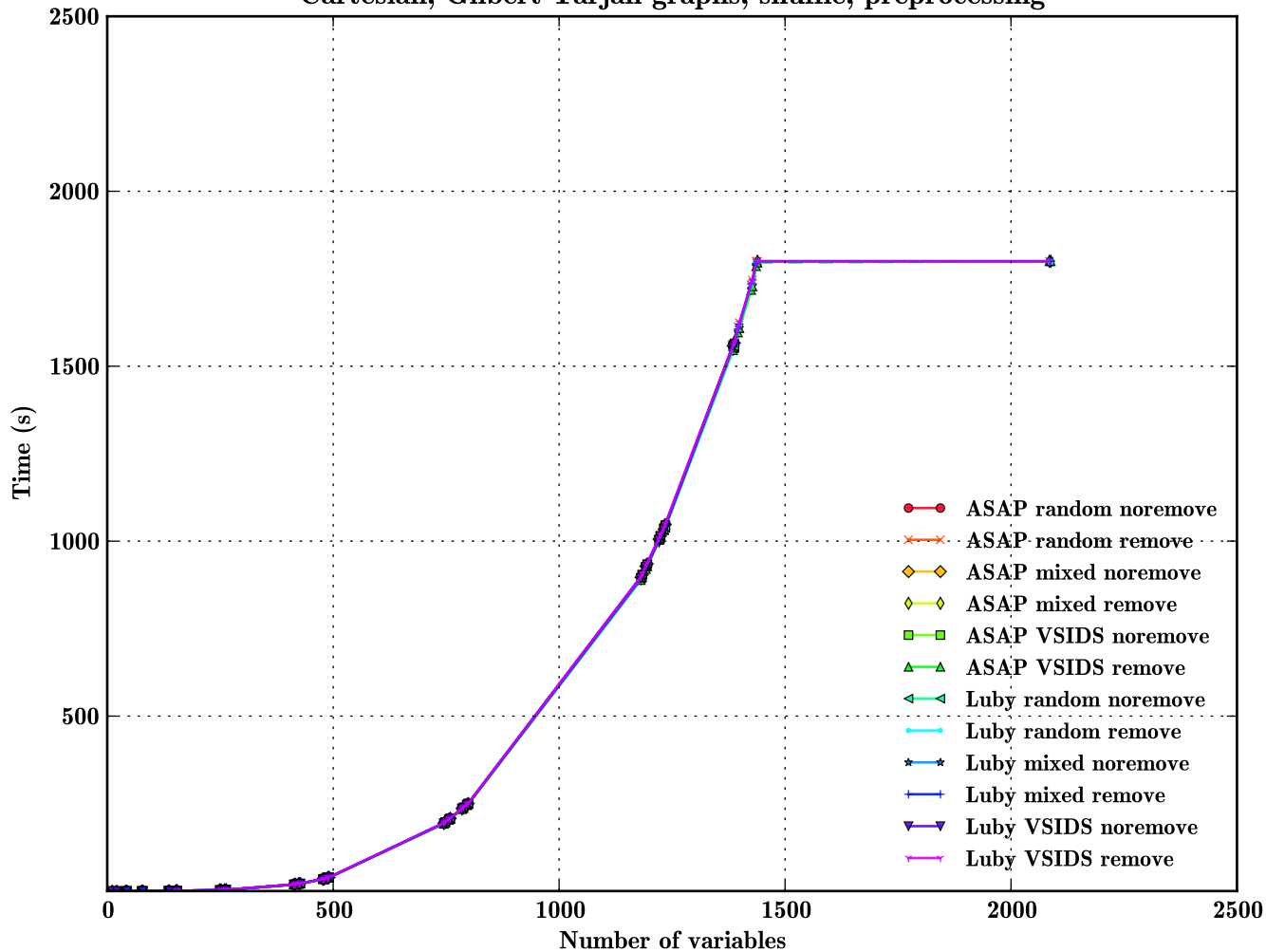
Cartesian, Gilbert-Tarjan graphs, no shuffle, no preprocessing





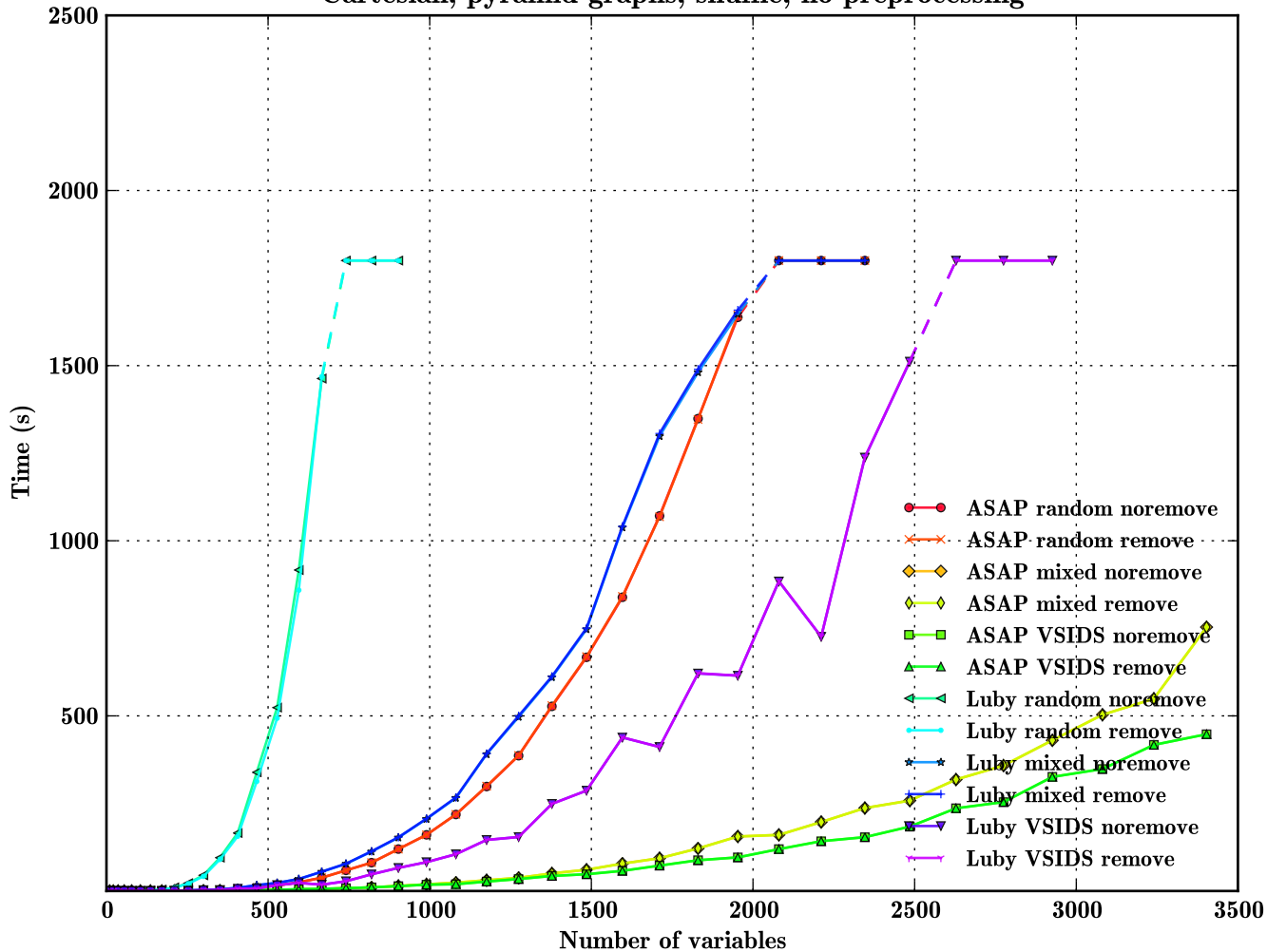


Cartesian, Gilbert-Tarjan graphs, shuffle, preprocessing



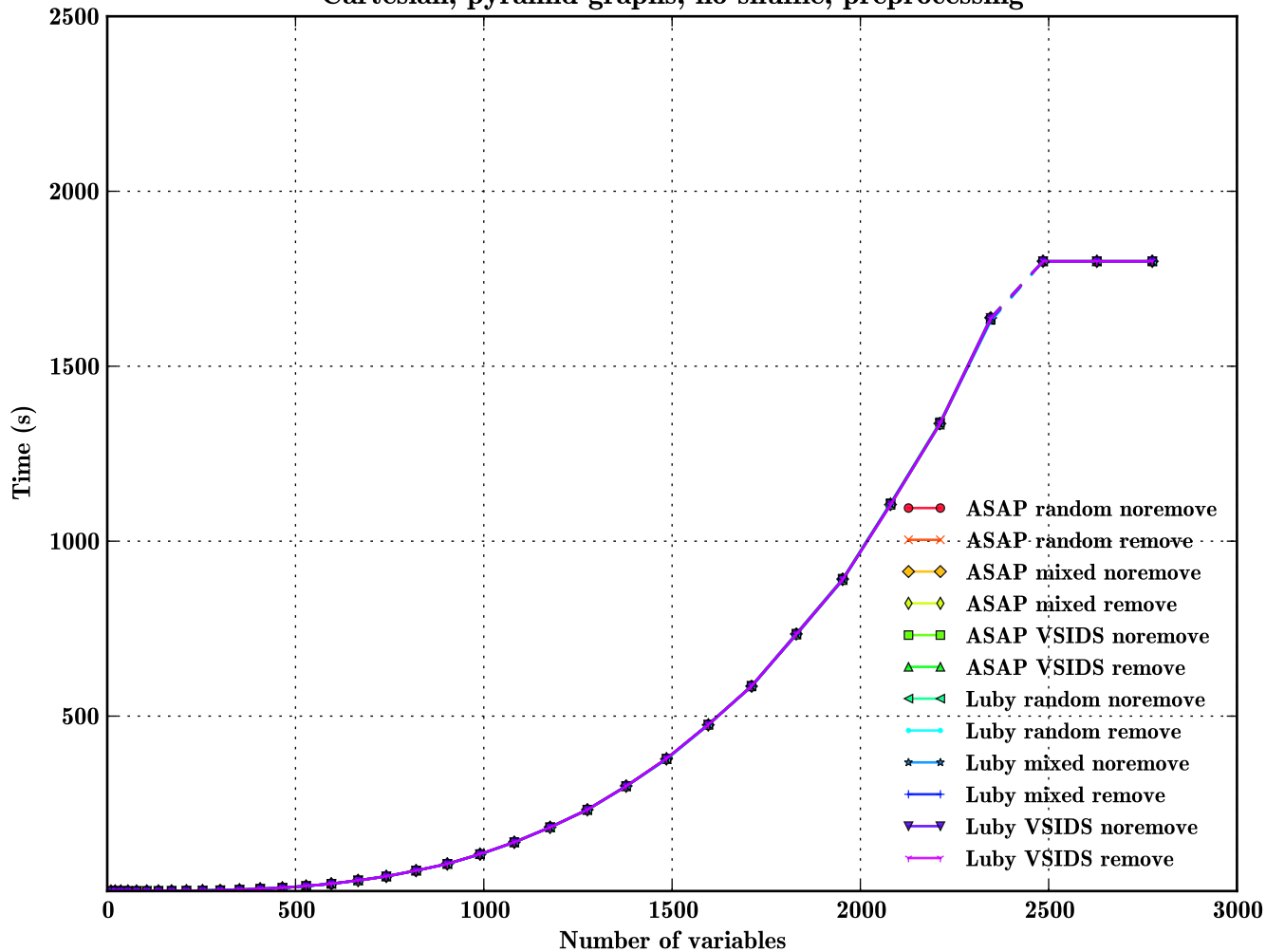


Cartesian, pyramid graphs, shuffle, no preprocessing





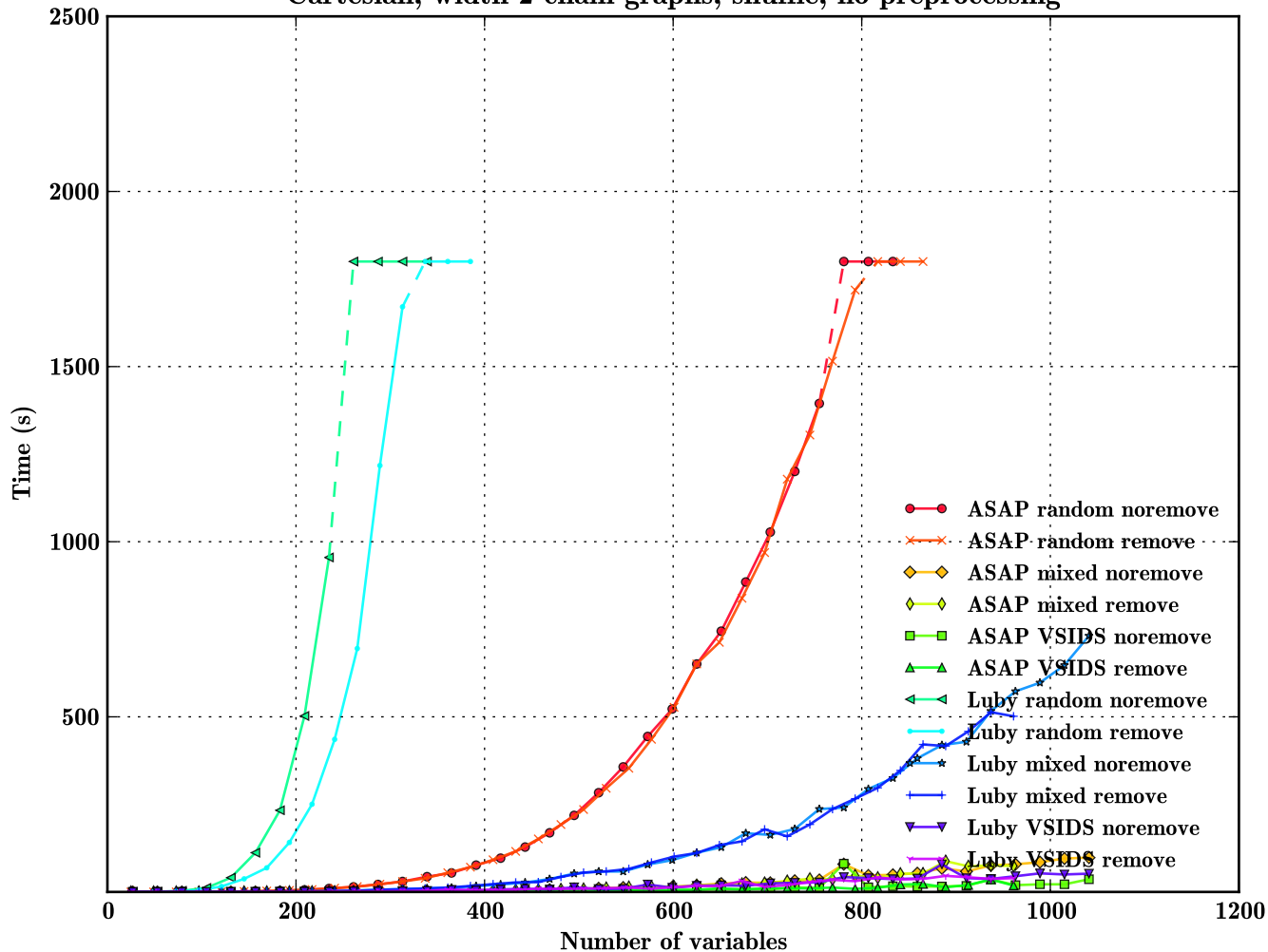
Cartesian, pyramid graphs, no shuffle, preprocessing





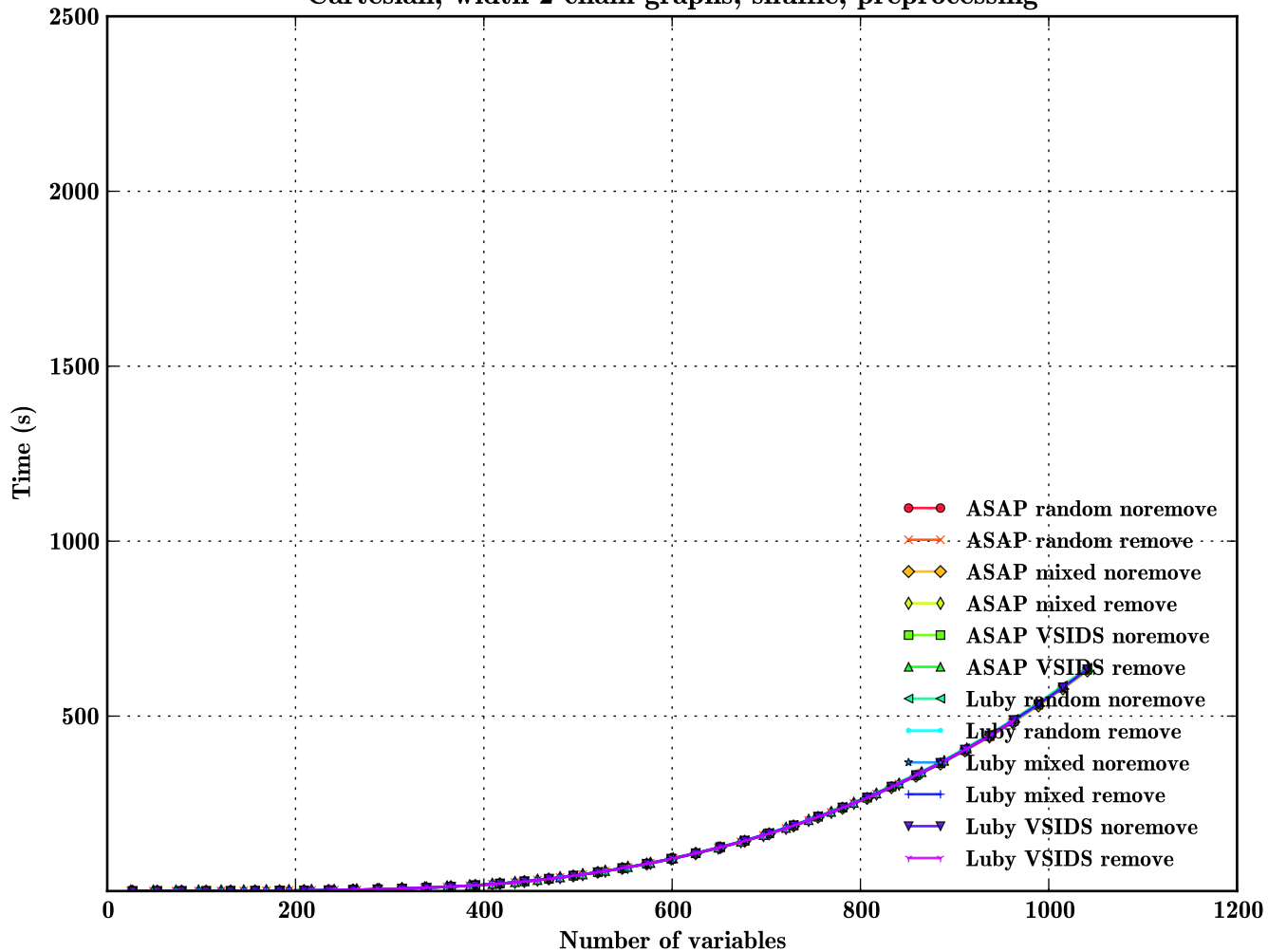


Cartesian, width 2 chain graphs, shuffle, no preprocessing

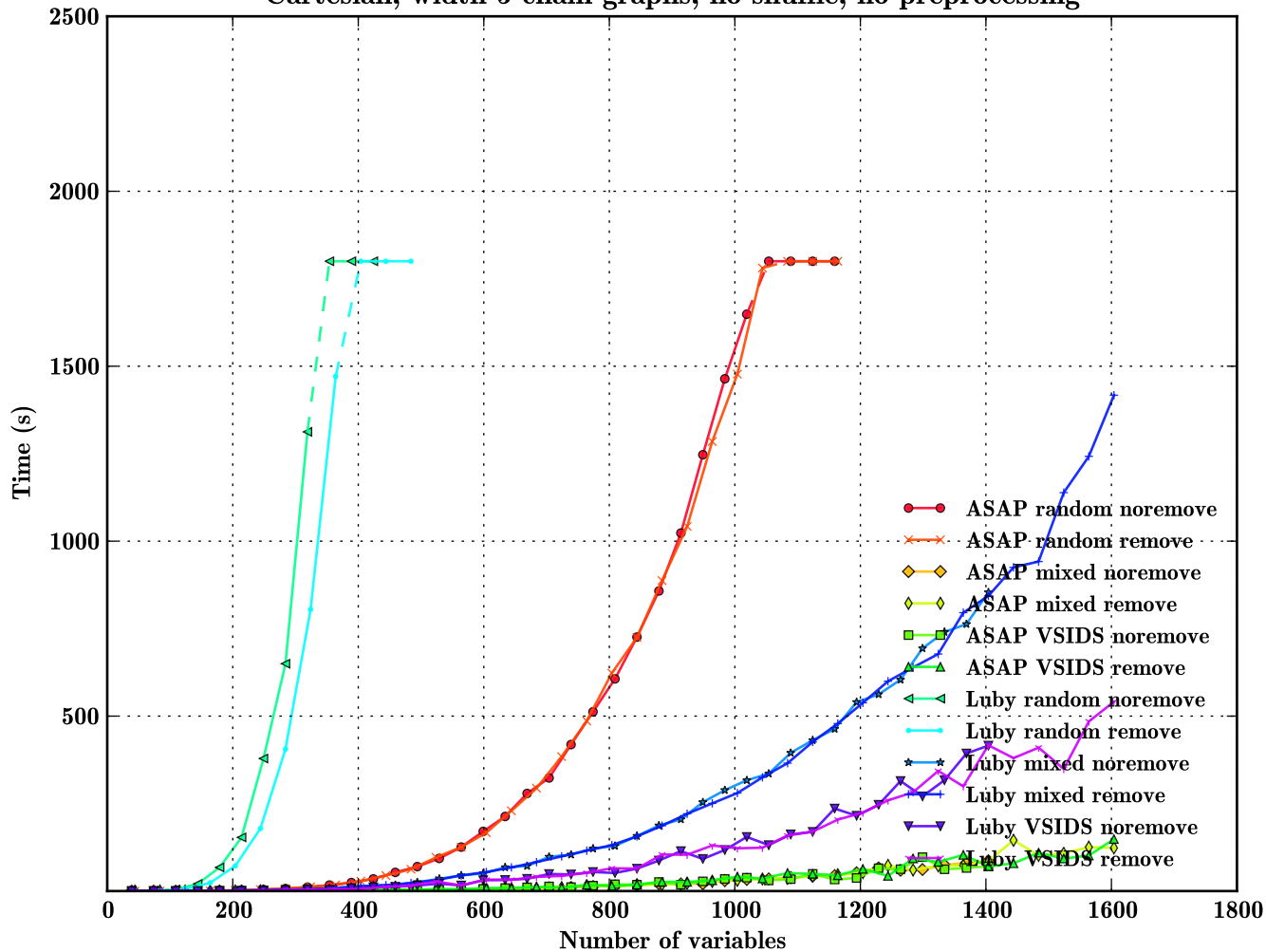




Cartesian, width 2 chain graphs, shuffle, preprocessing



Cartesian, width 5 chain graphs, no shuffle, no preprocessing

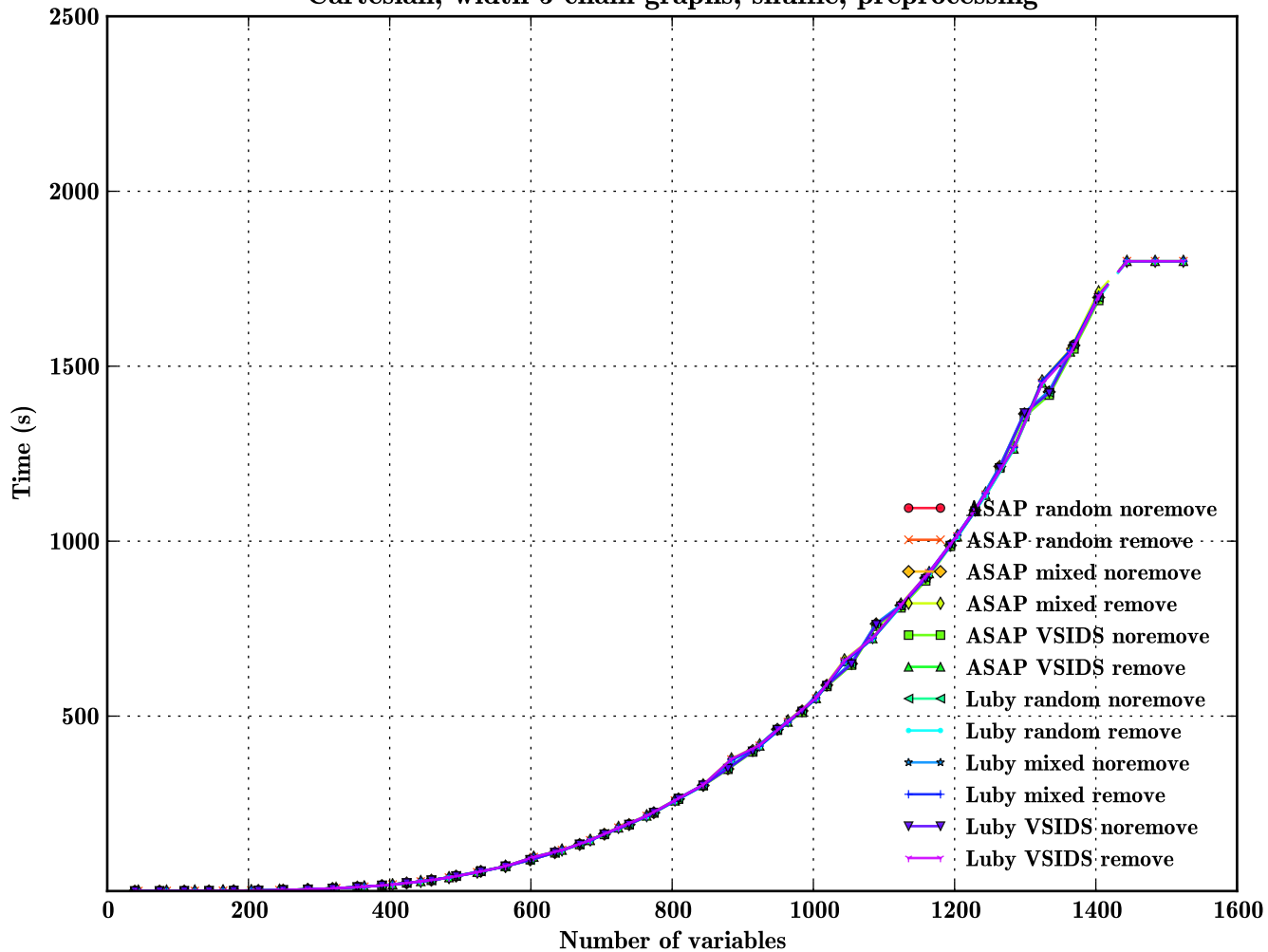








Cartesian, width 5 chain graphs, shuffle, preprocessing



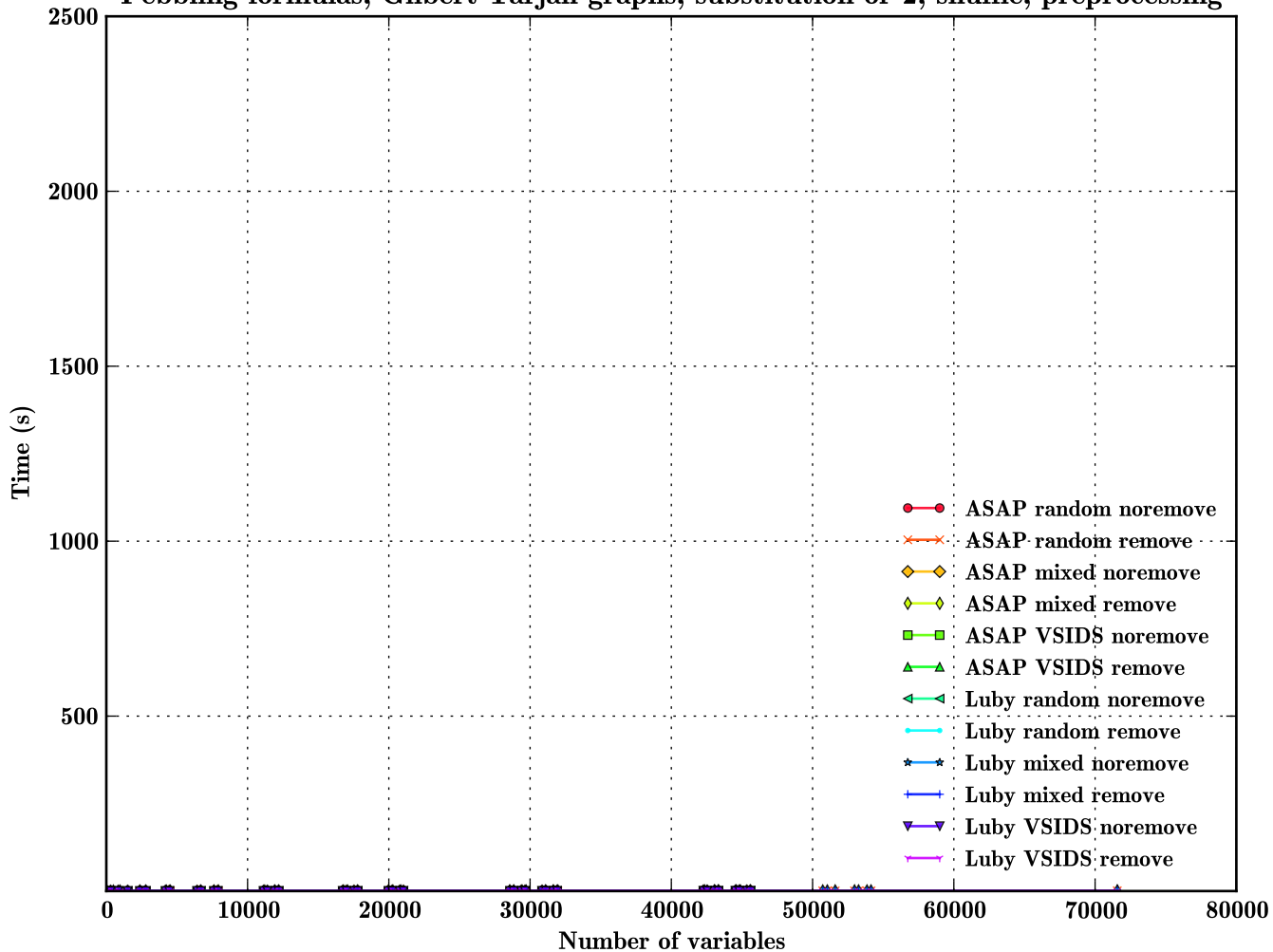
# **Pebbling formulas with substitution or of arity 2**







# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, shuffle, preprocessing





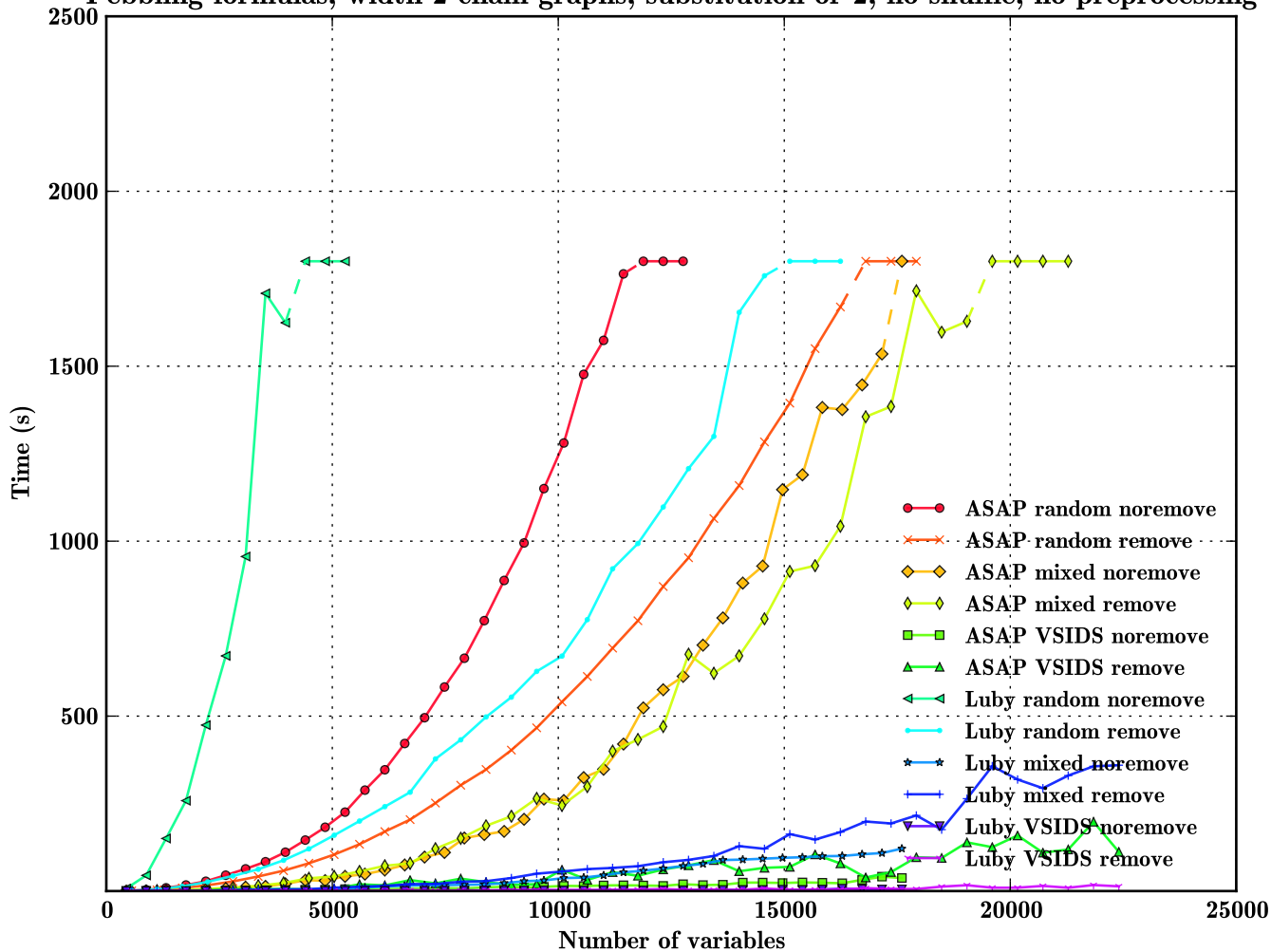




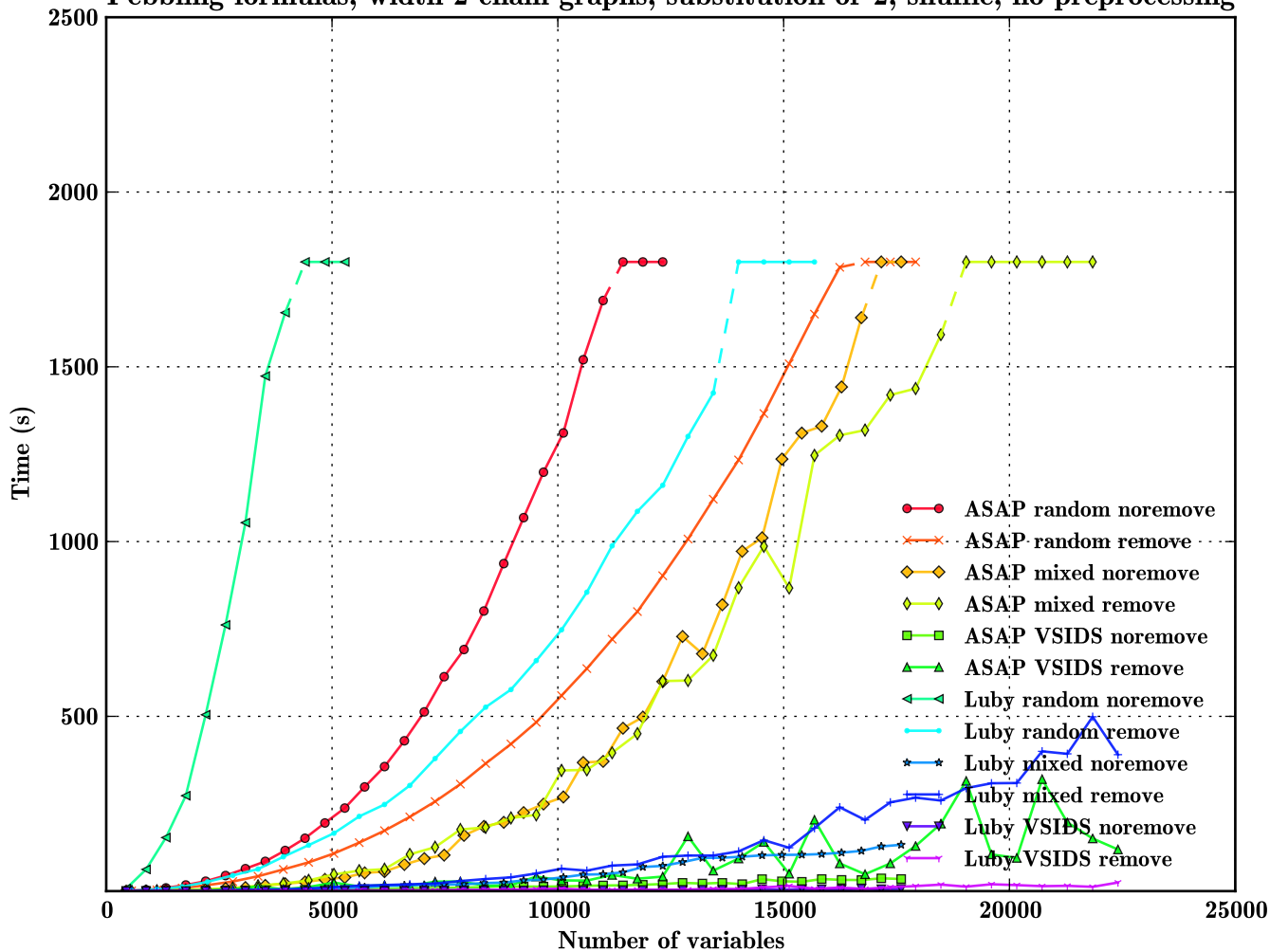




Pebbling formulas, width 2 chain graphs, substitution or 2, no shuffle, no preprocessing



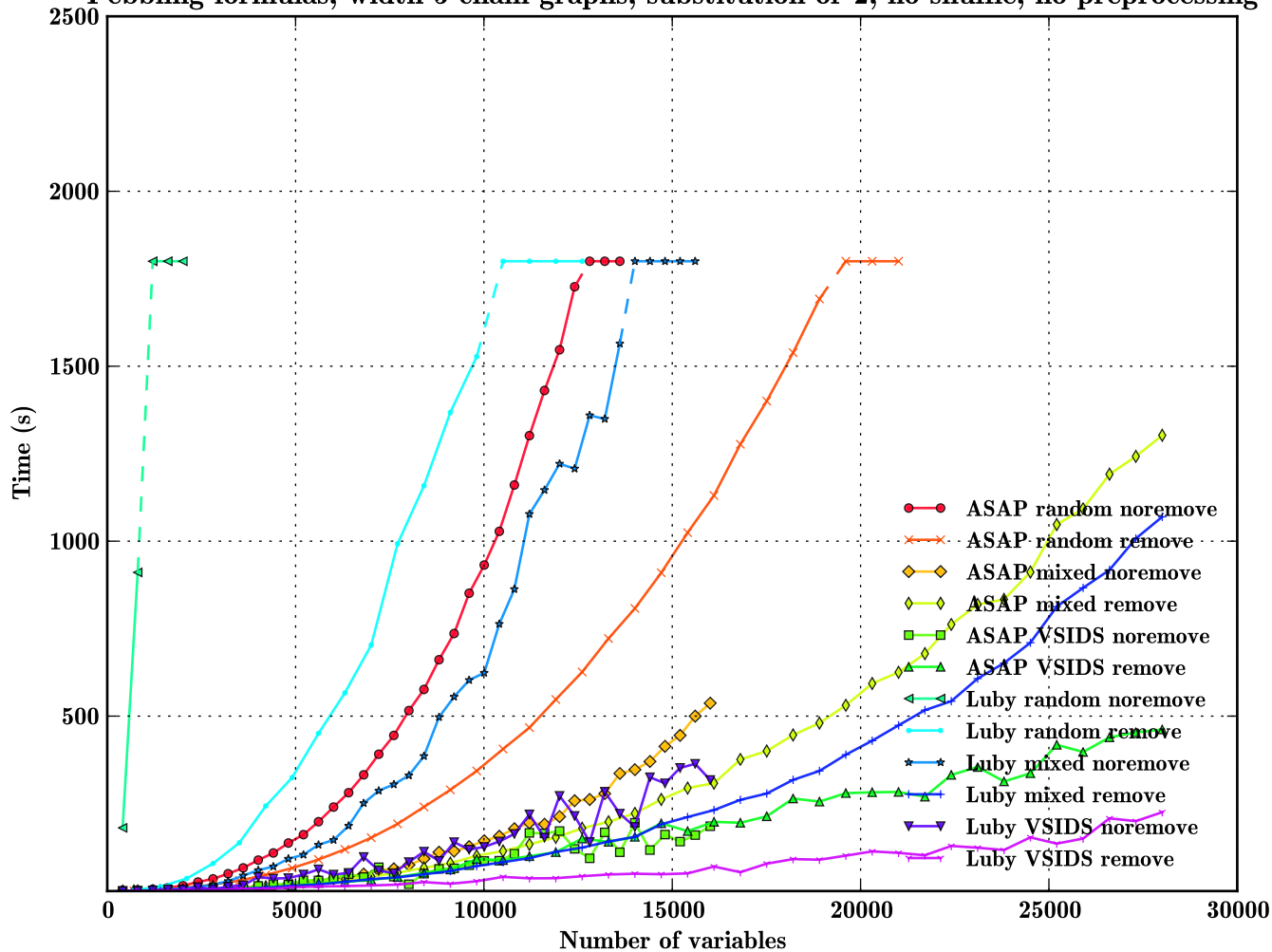
Pebbling formulas, width 2 chain graphs, substitution or 2, shuffle, no preprocessing







Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, no preprocessing











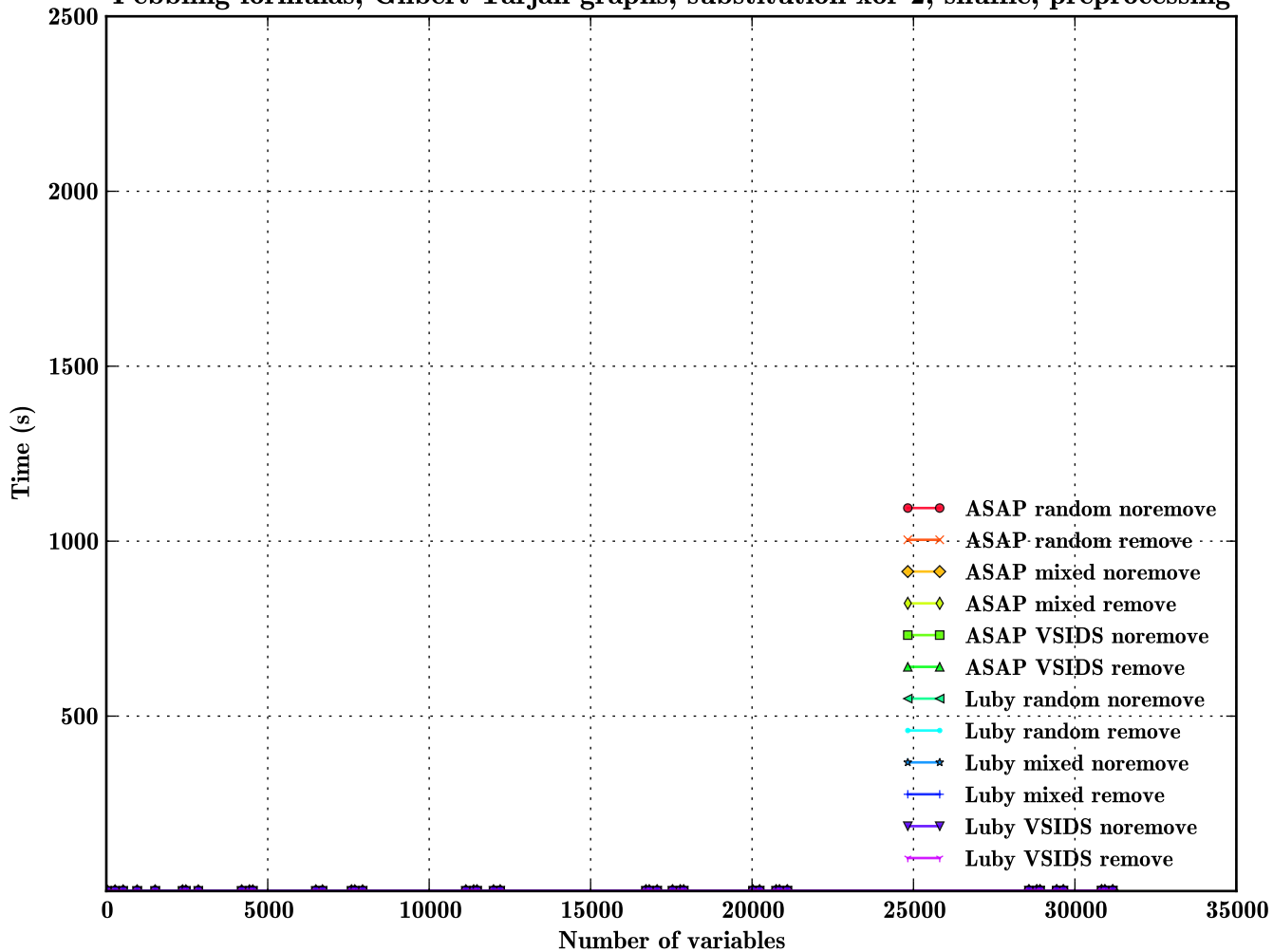
# **Pebbling formulas with substitution xor of arity 2**





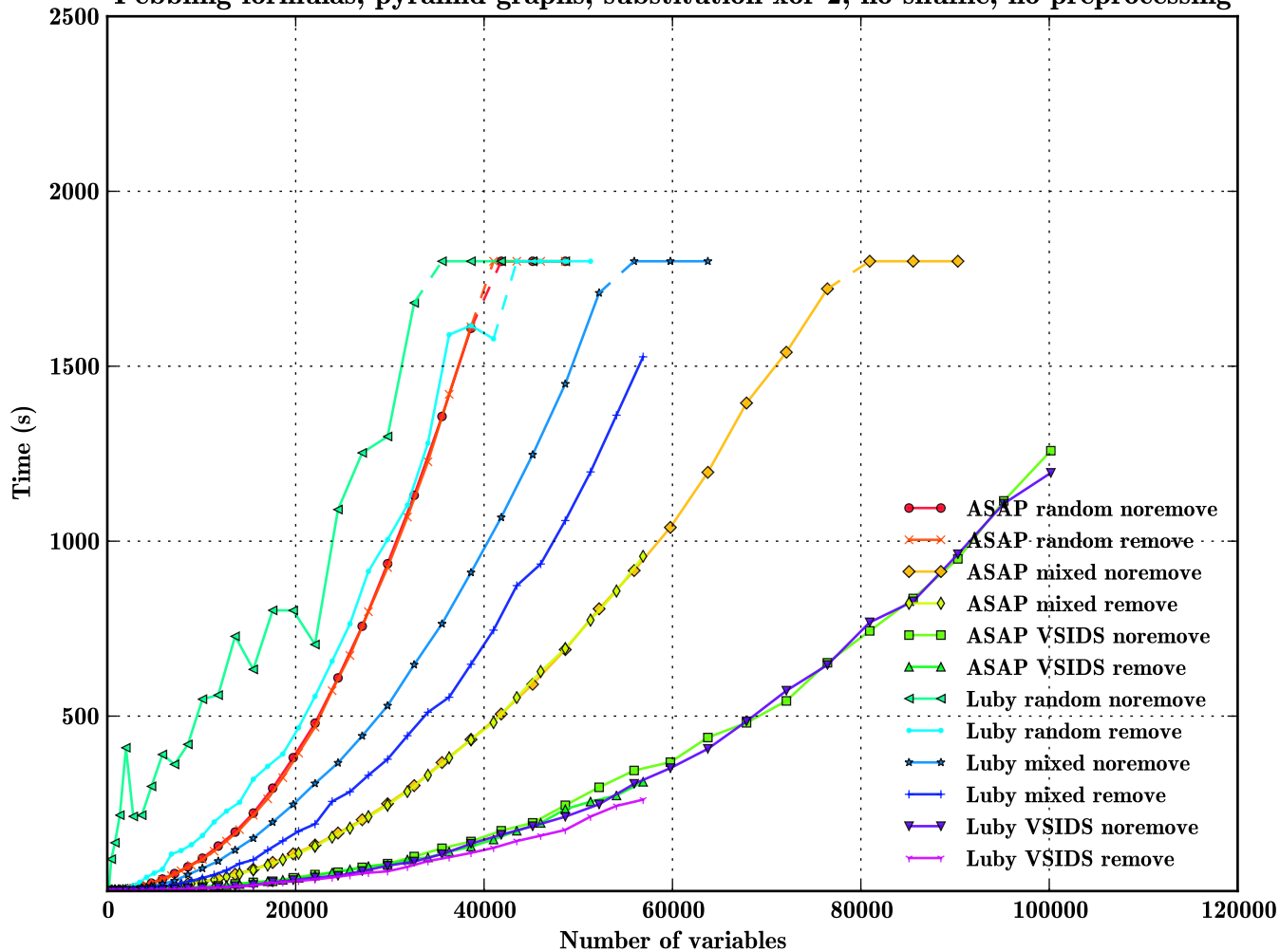


# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, preprocessing

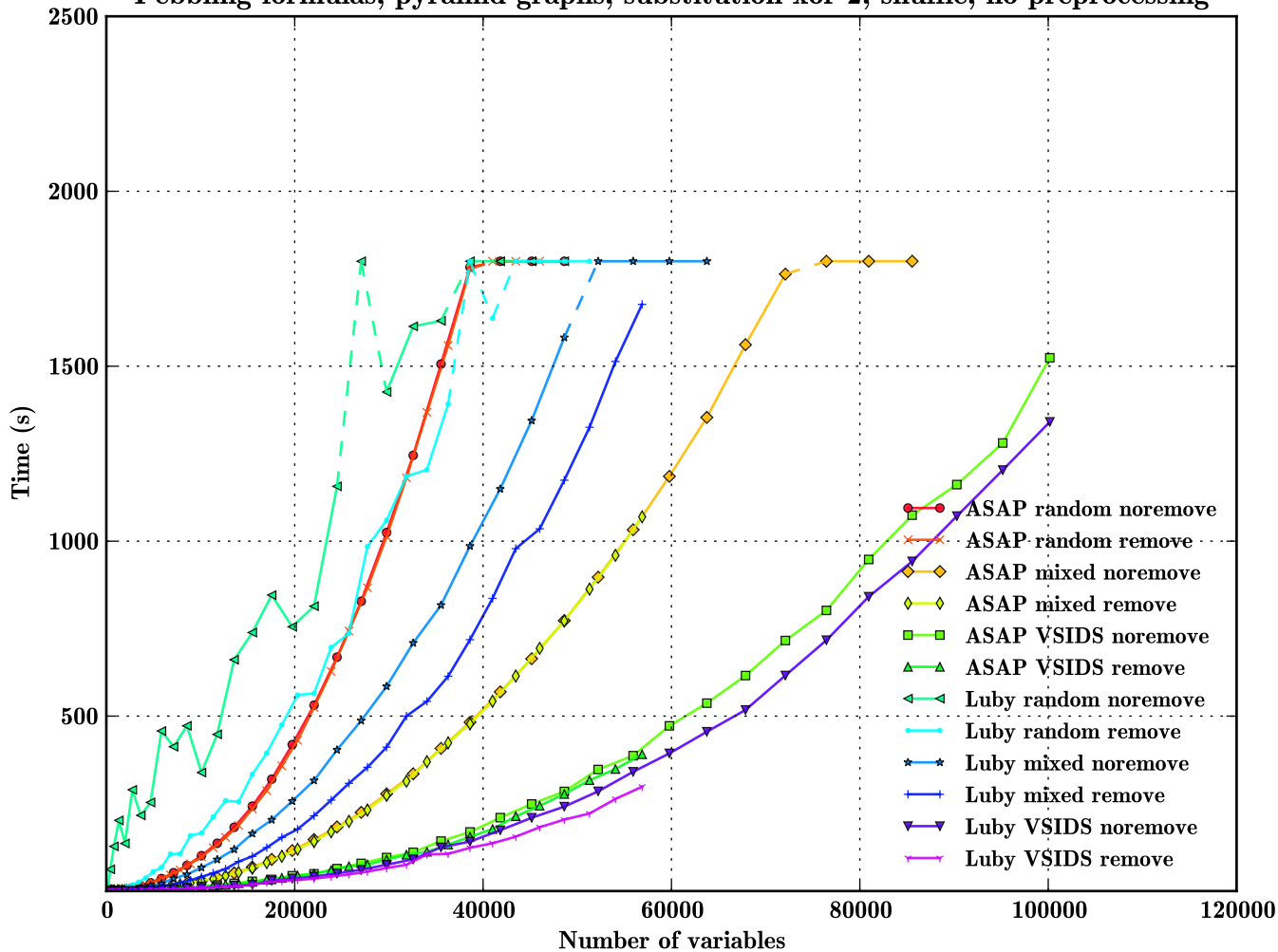




Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, no preprocessing



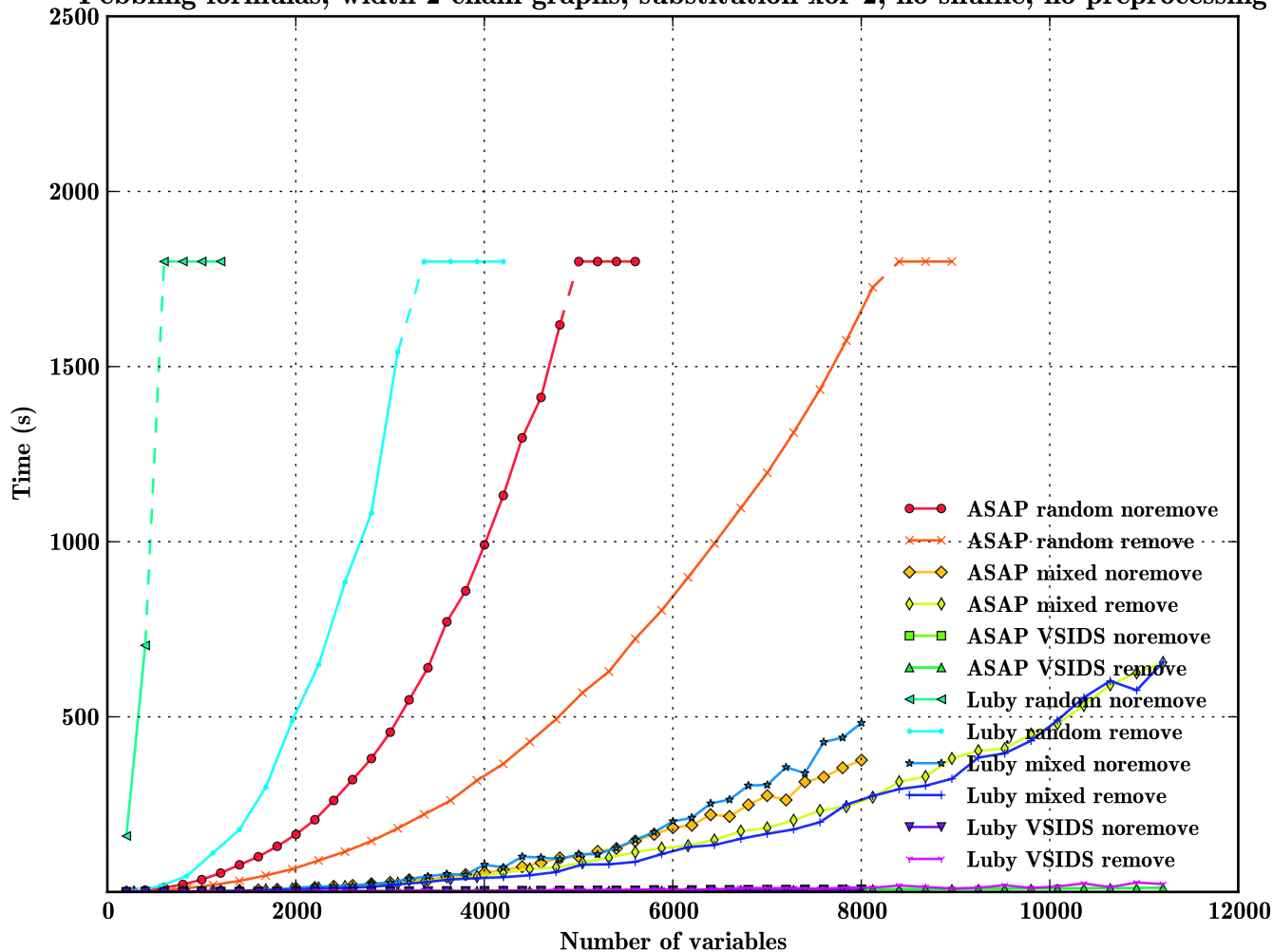
Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, no preprocessing



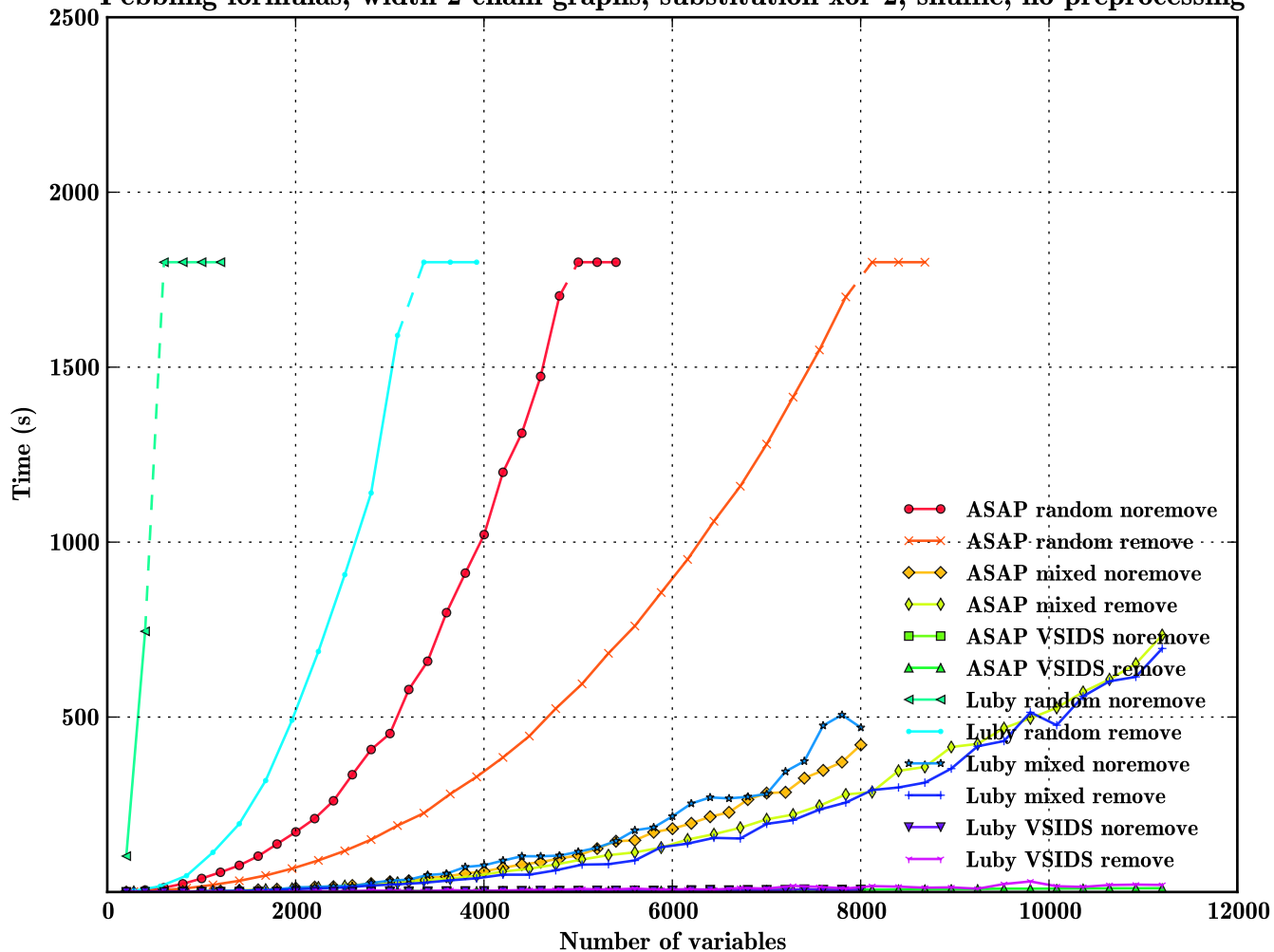




Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, no preprocessing



Pebbling formulas, width 2 chain graphs, substitution xor 2, shuffle, no preprocessing













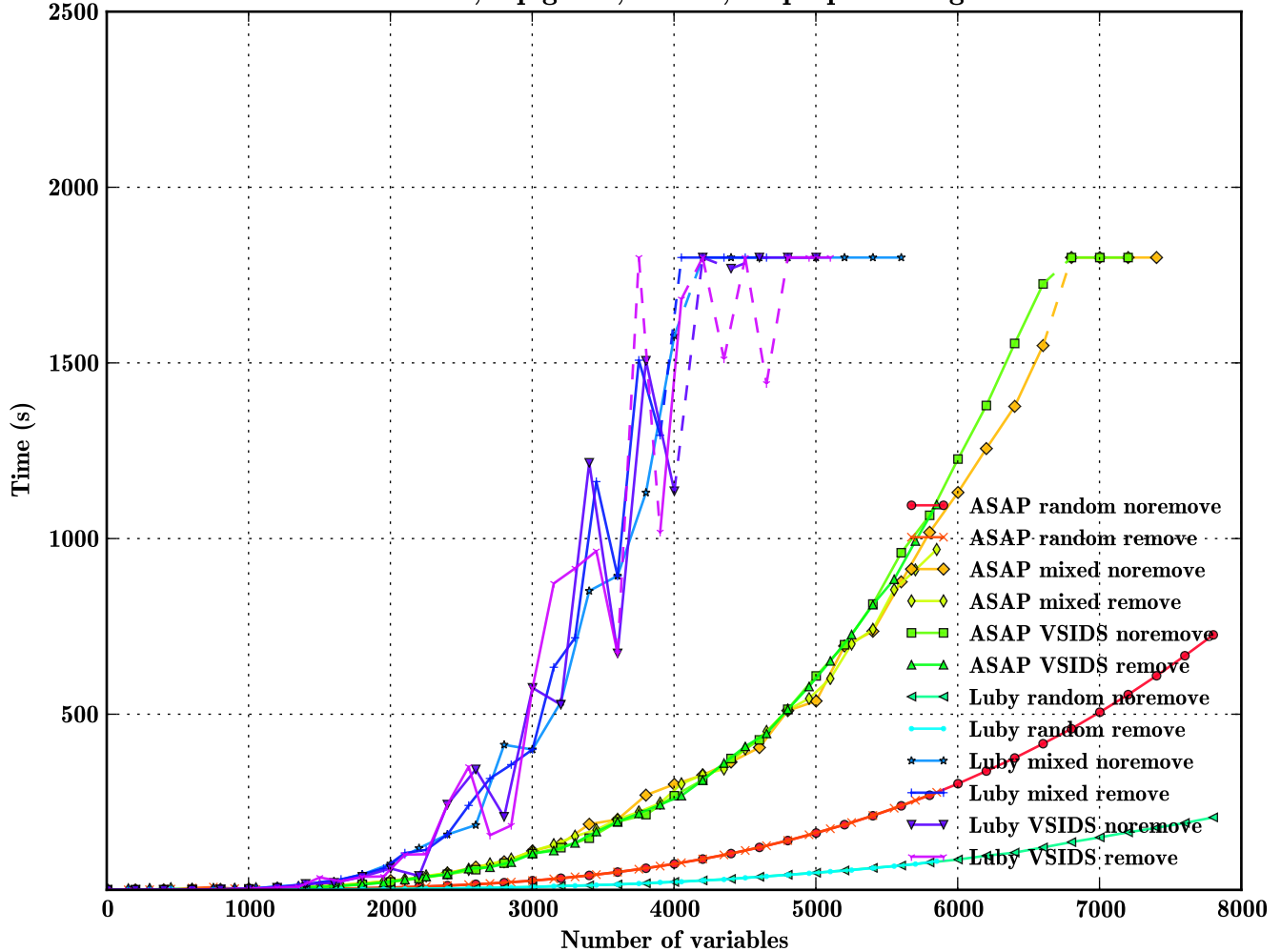




# **Relativized pigeonhole principle formulas (RPHP)**



RPHP, 2 pigeons, shuffle, no preprocessing























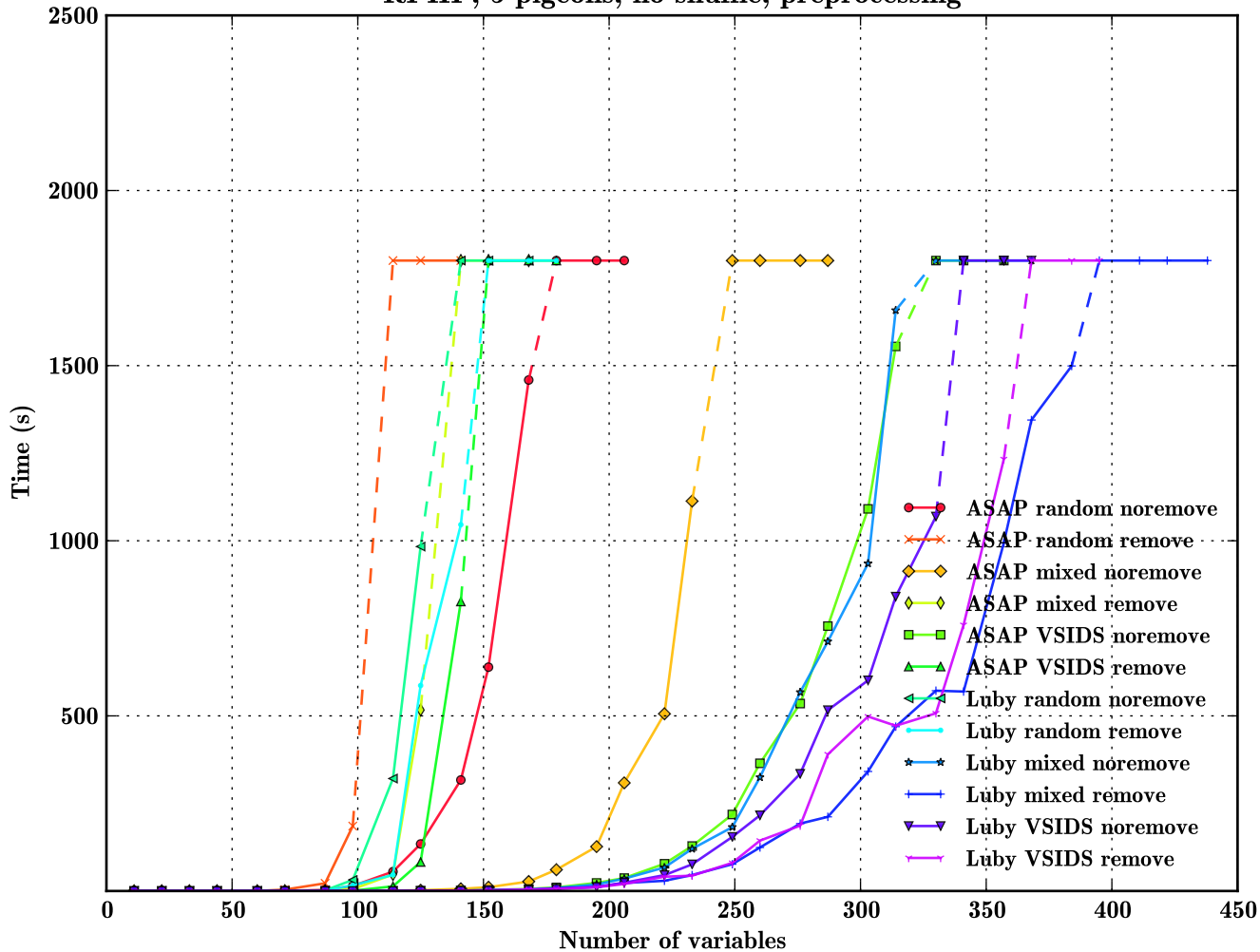








RPHP, 5 pigeons, no shuffle, preprocessing





# Tseitin grids









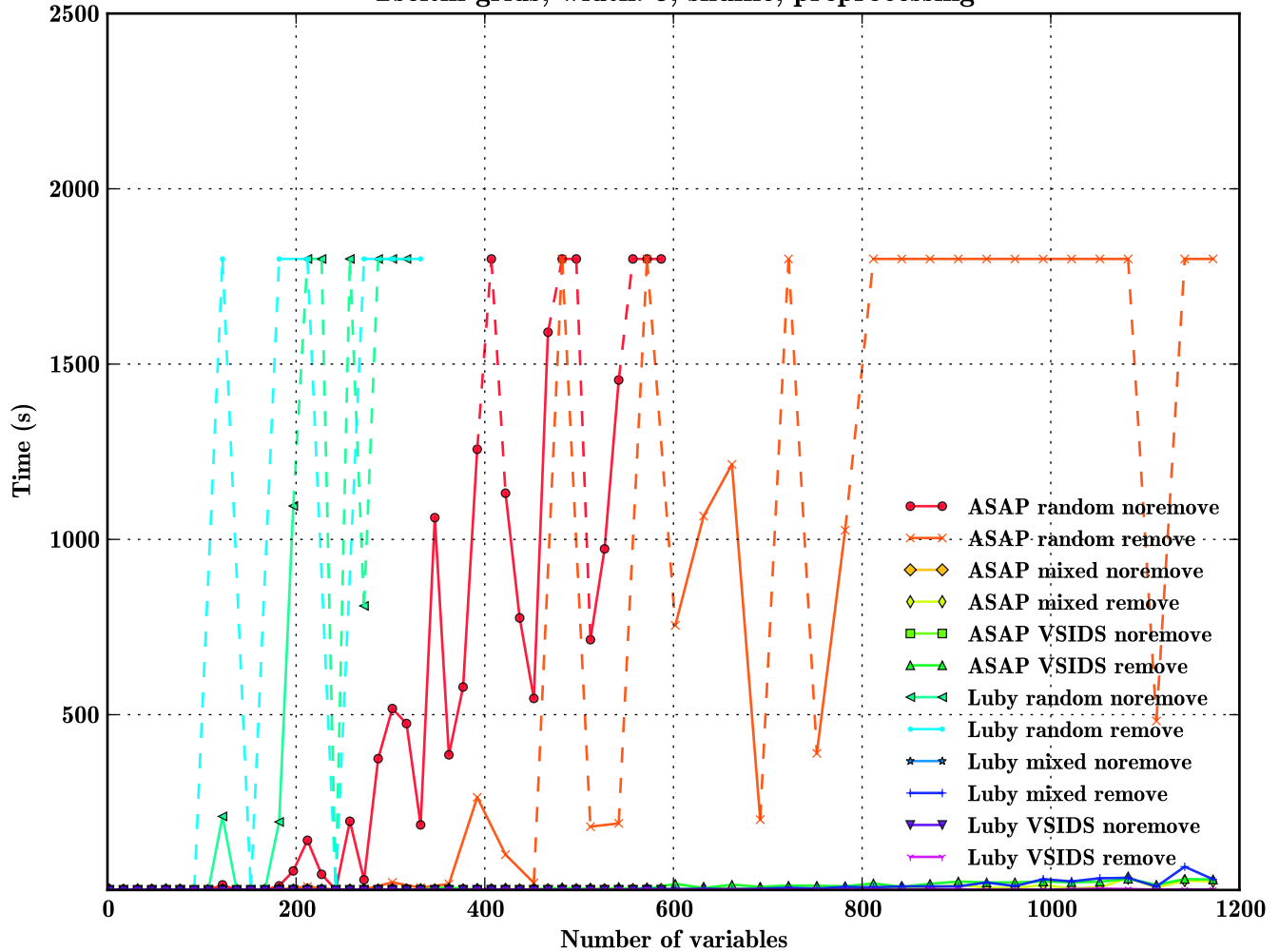




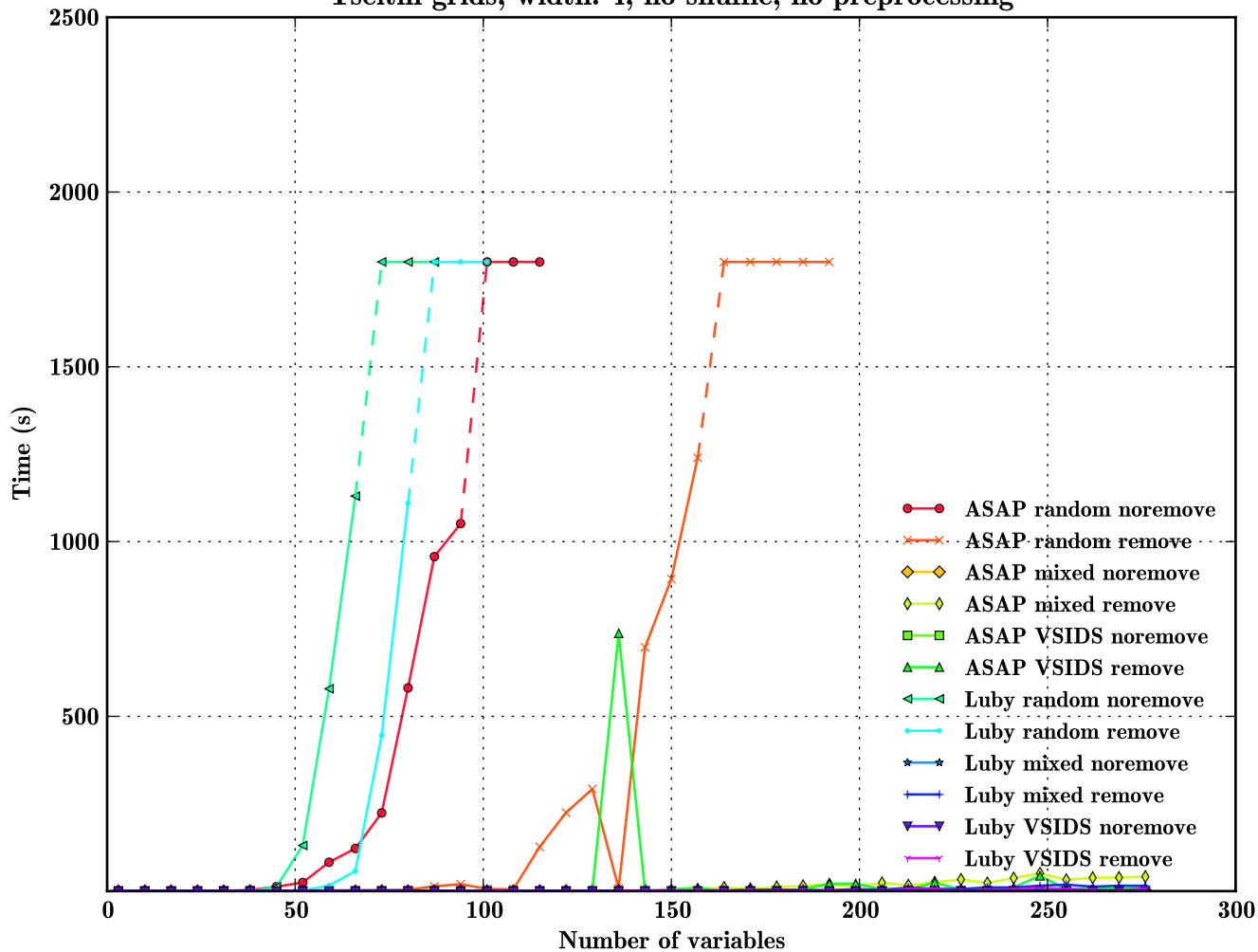




Tseitin grids, width: 3, shuffle, preprocessing



Tsetin grids, width: 4, no shuffle, no preprocessing

















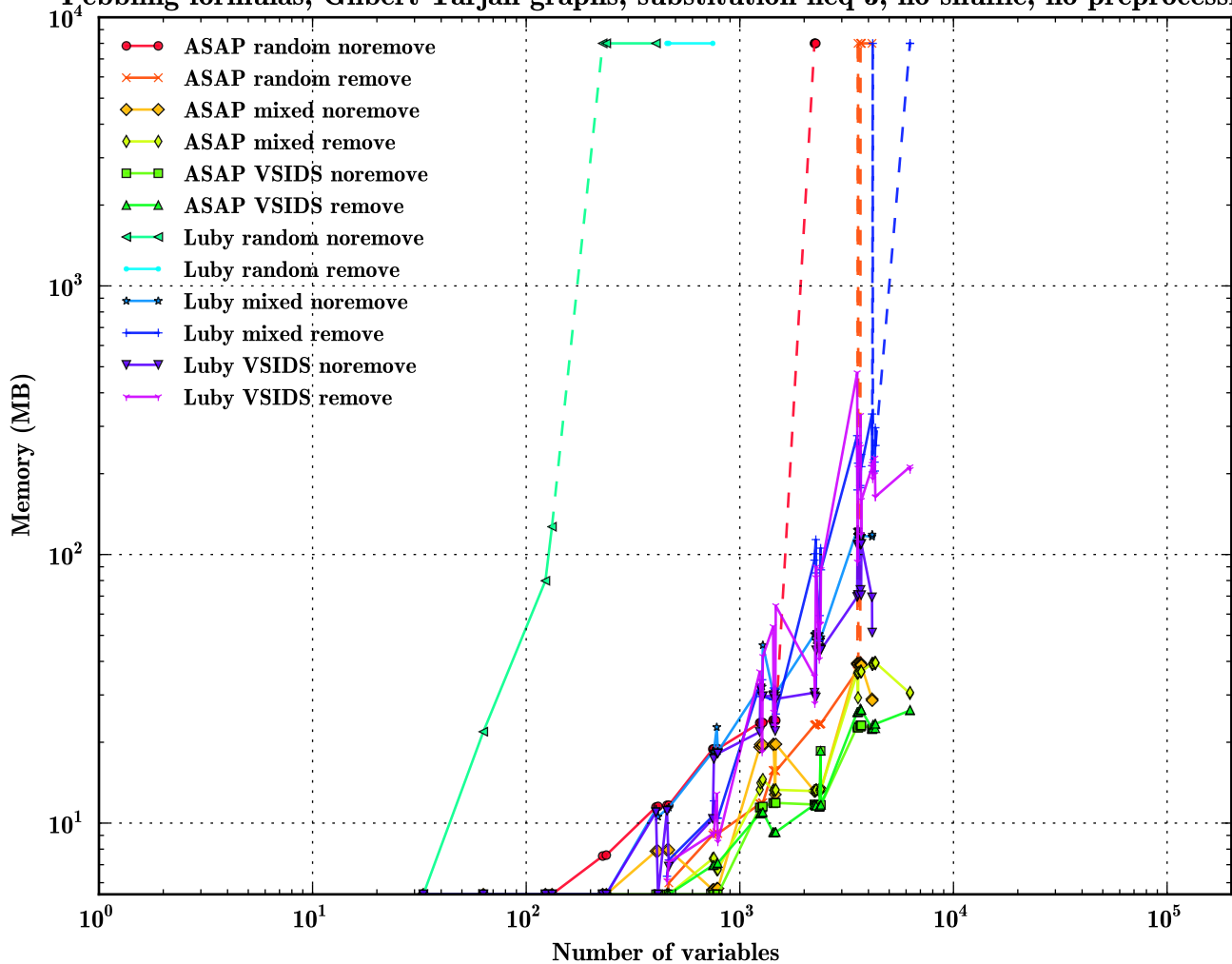


**Memory consumption**  
**loglog scale**

**Pebbling formulas with  
substitution neq(not all equal)  
of arity 3**



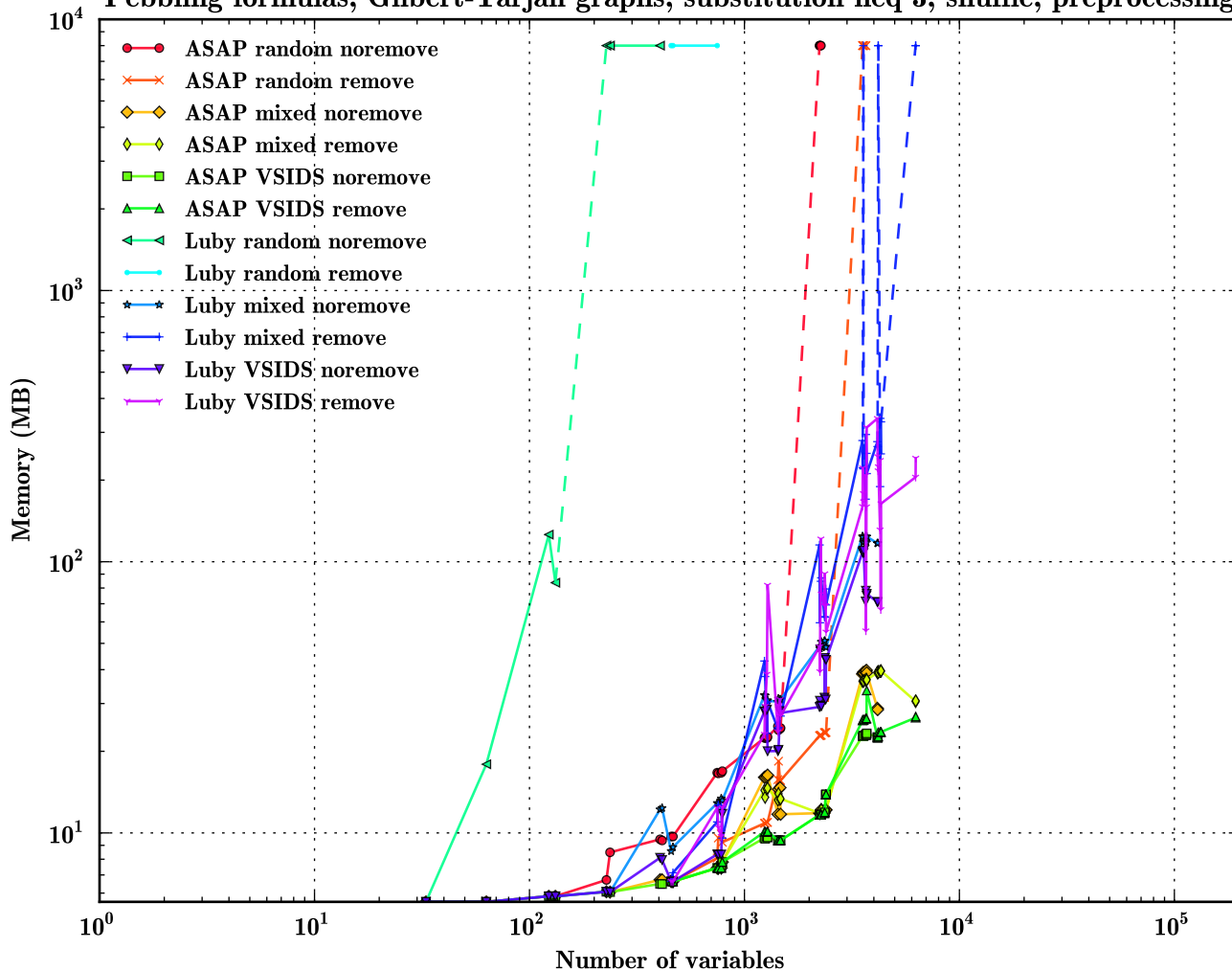
# Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, no preprocessing



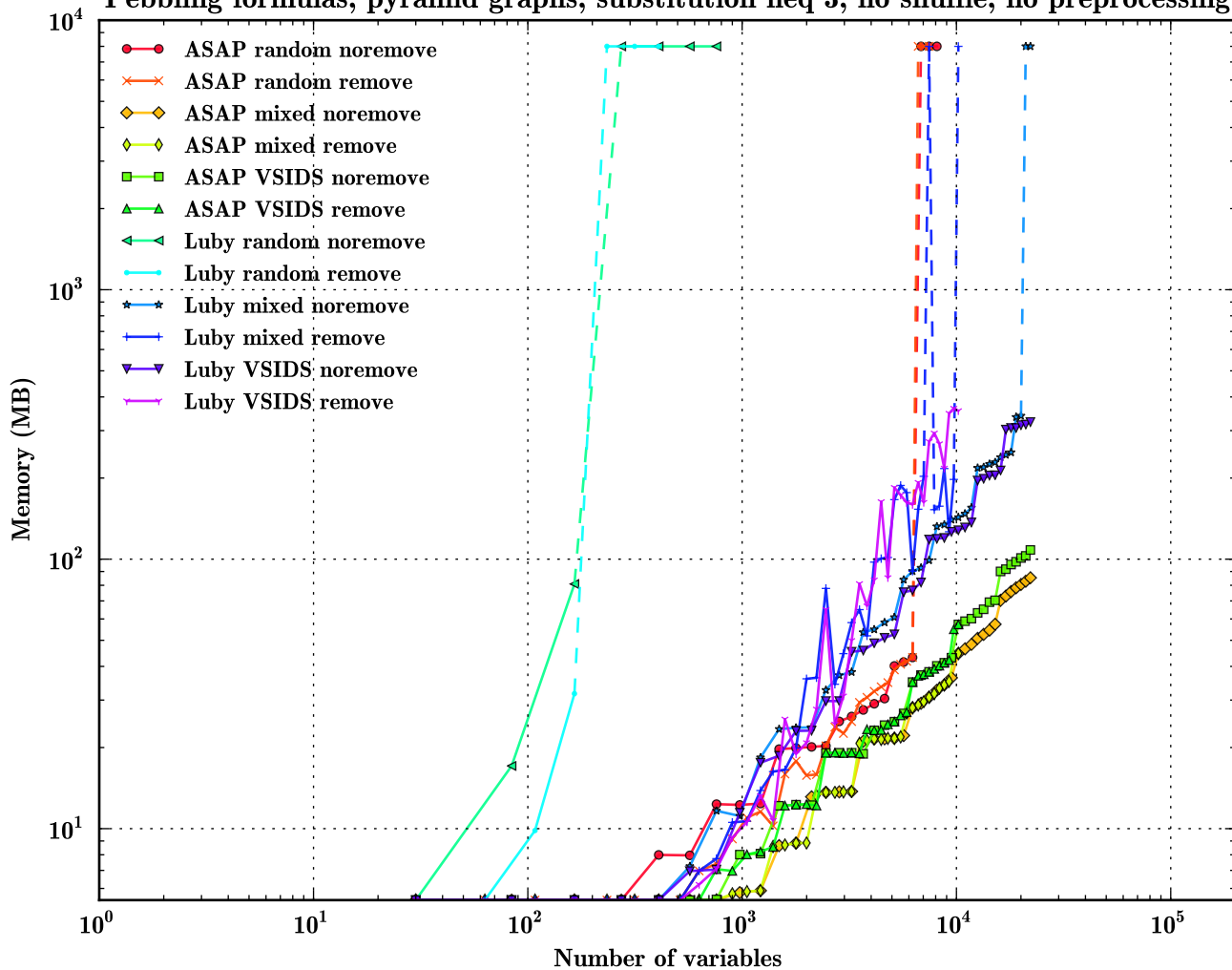




# Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, preprocessing



# Pebbling formulas, pyramid graphs, substitution neq 3, no shuffle, no preprocessing



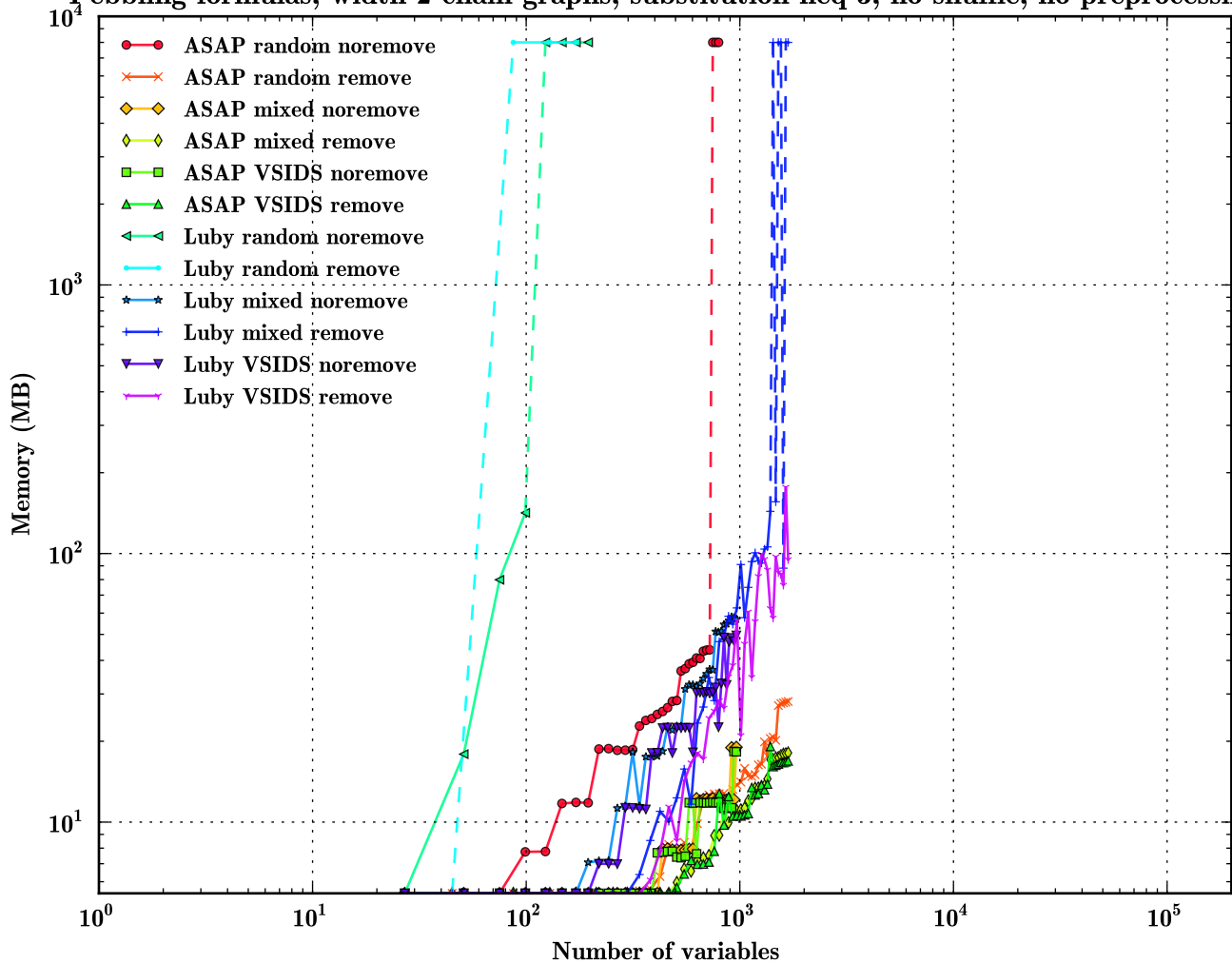






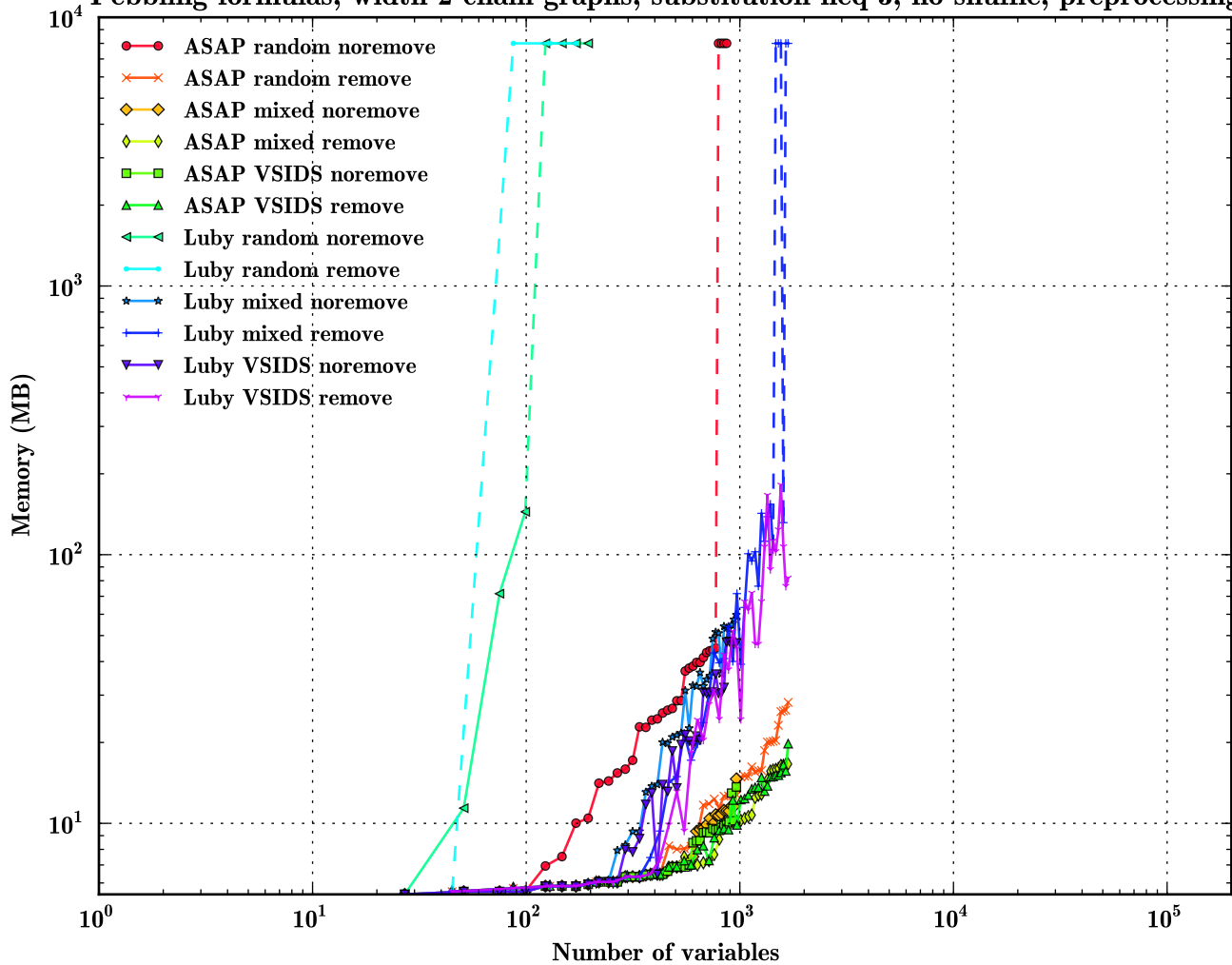


Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, no preprocessing

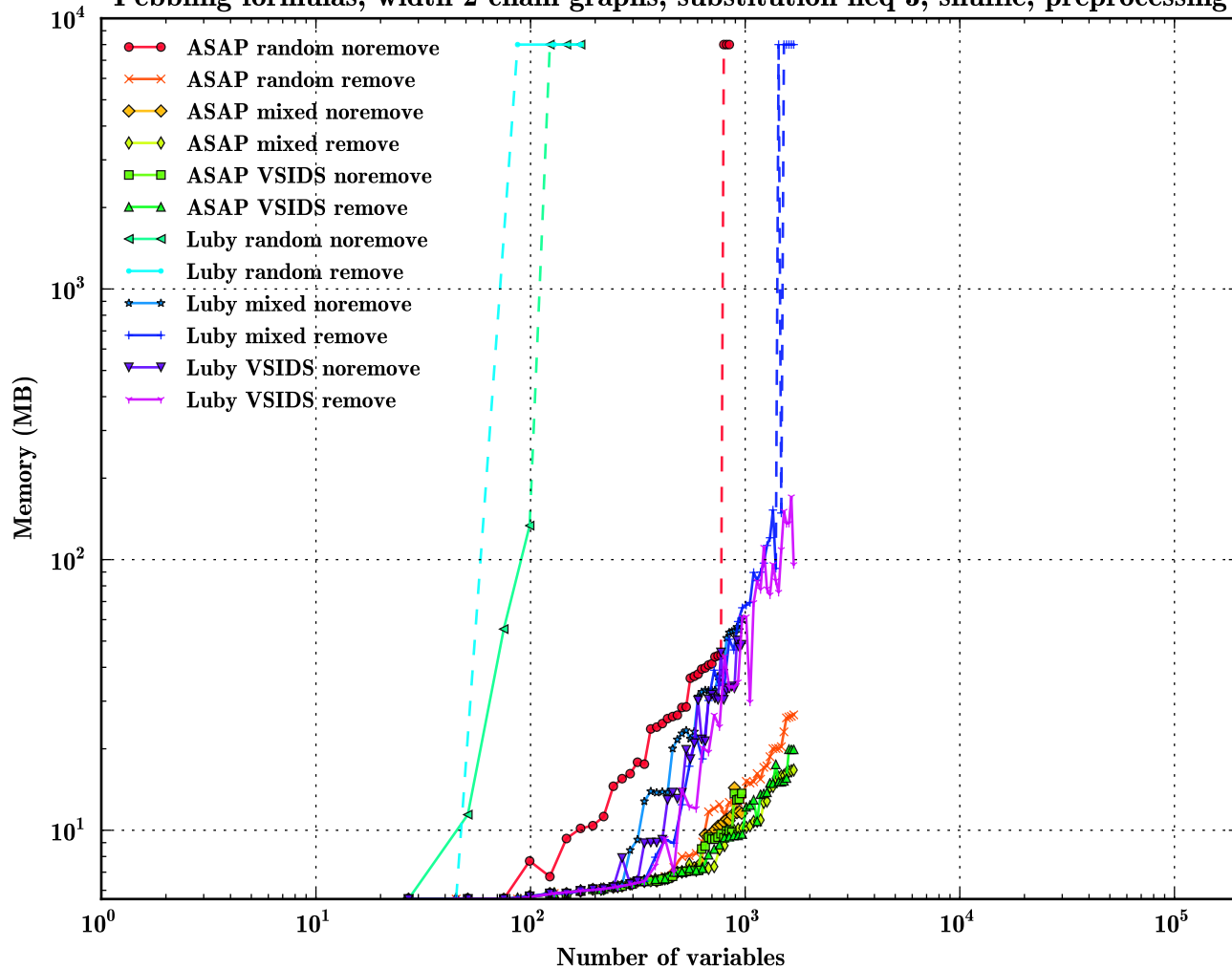




Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, preprocessing

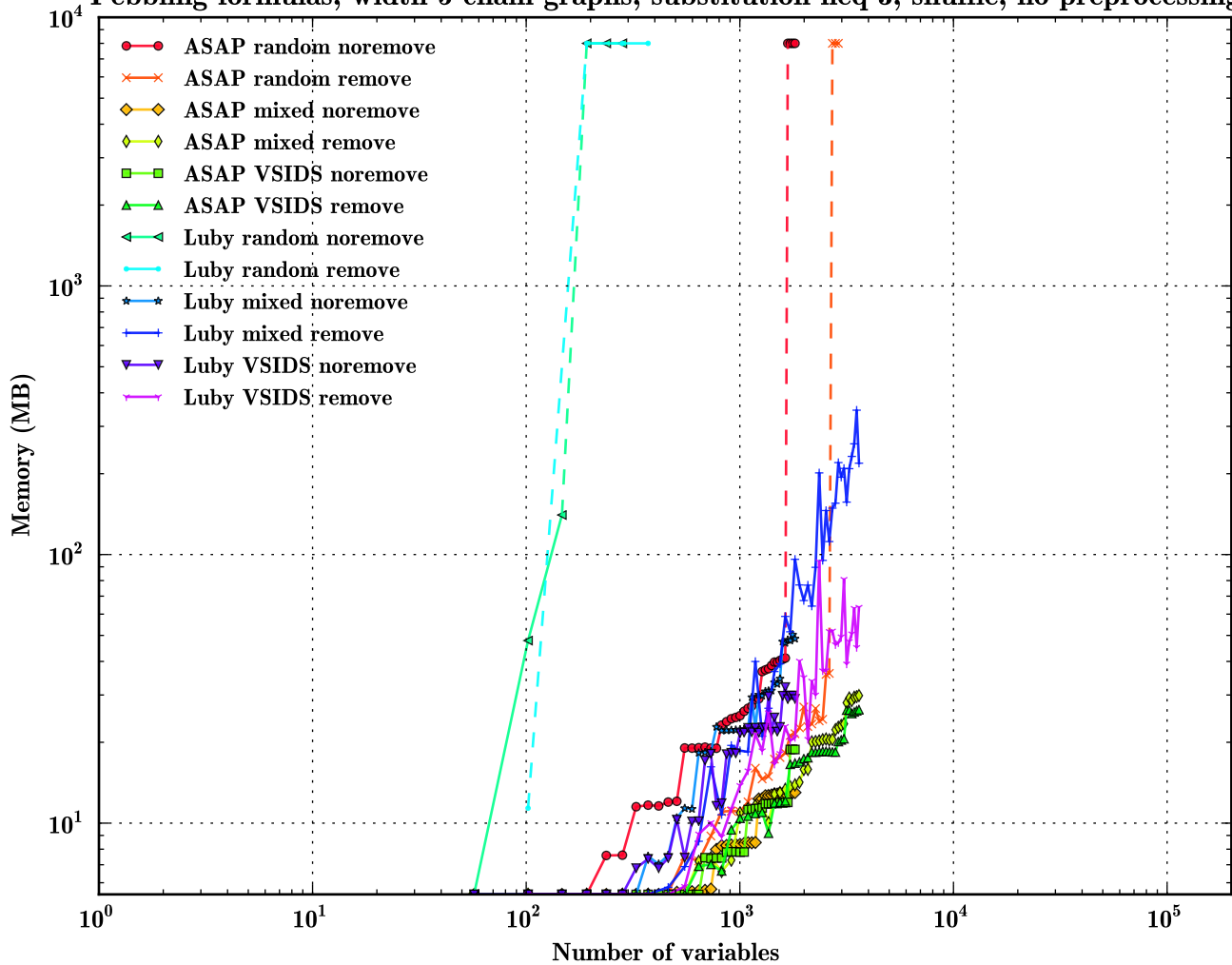


# Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, preprocessing

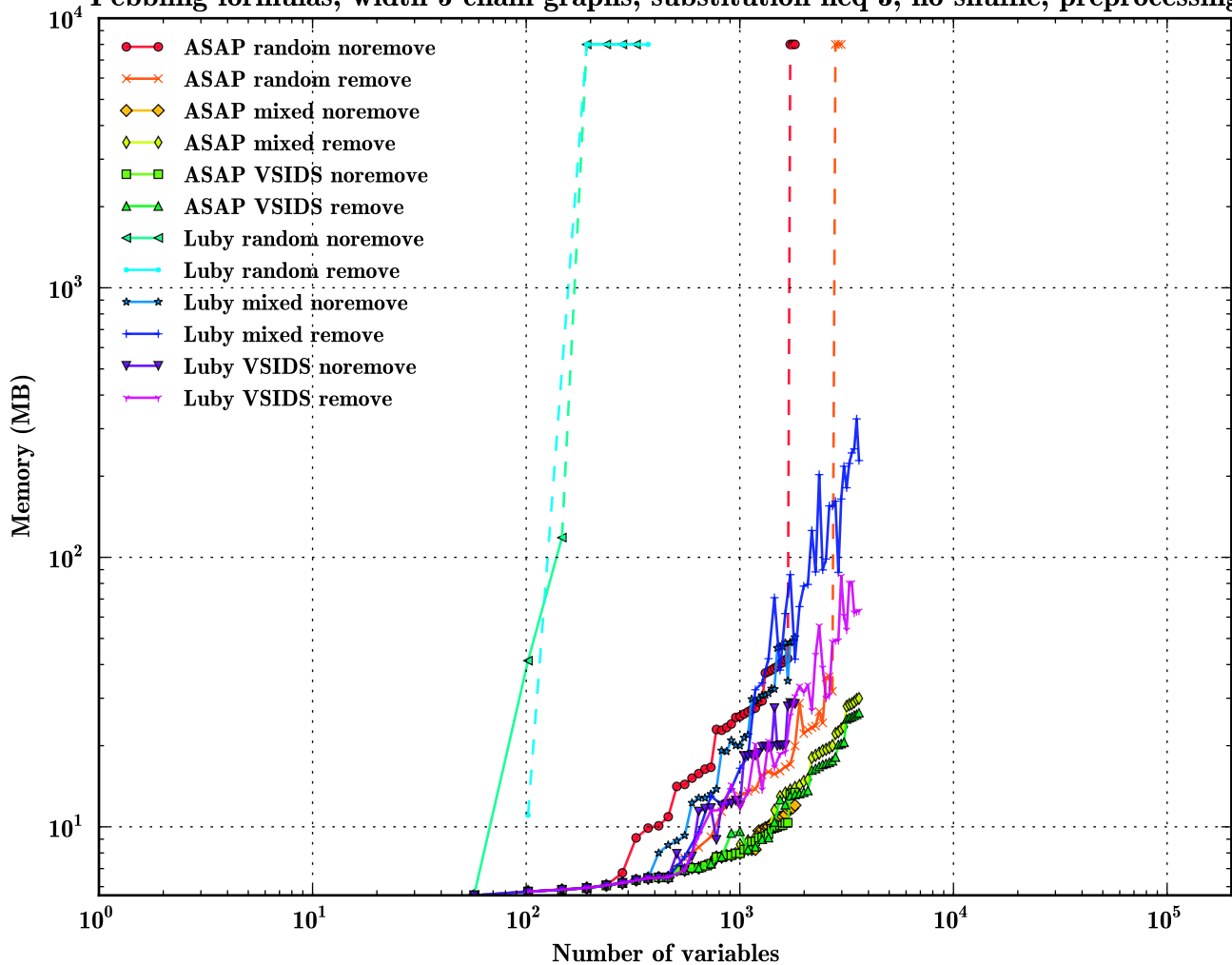




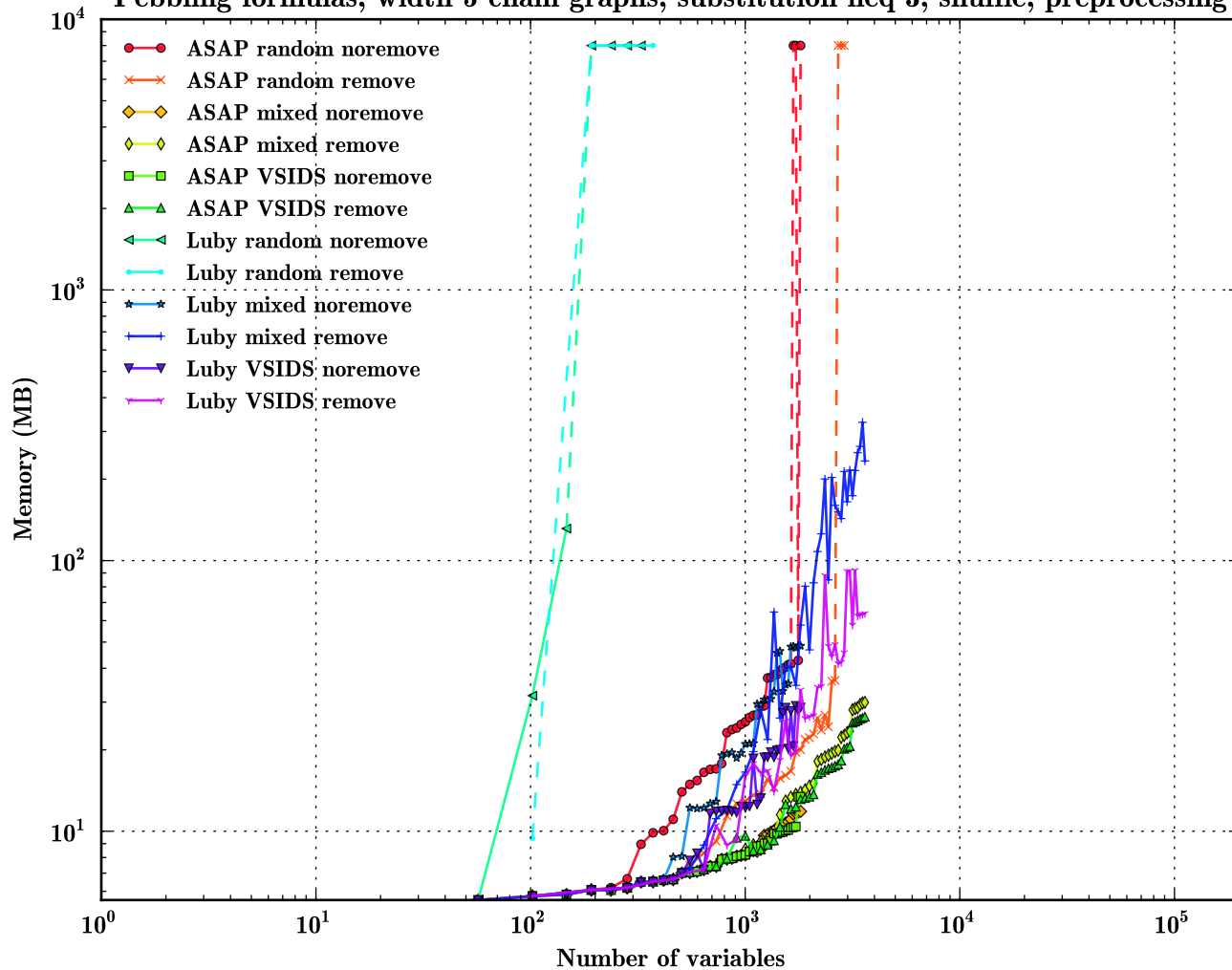
# Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, no preprocessing



# Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, preprocessing



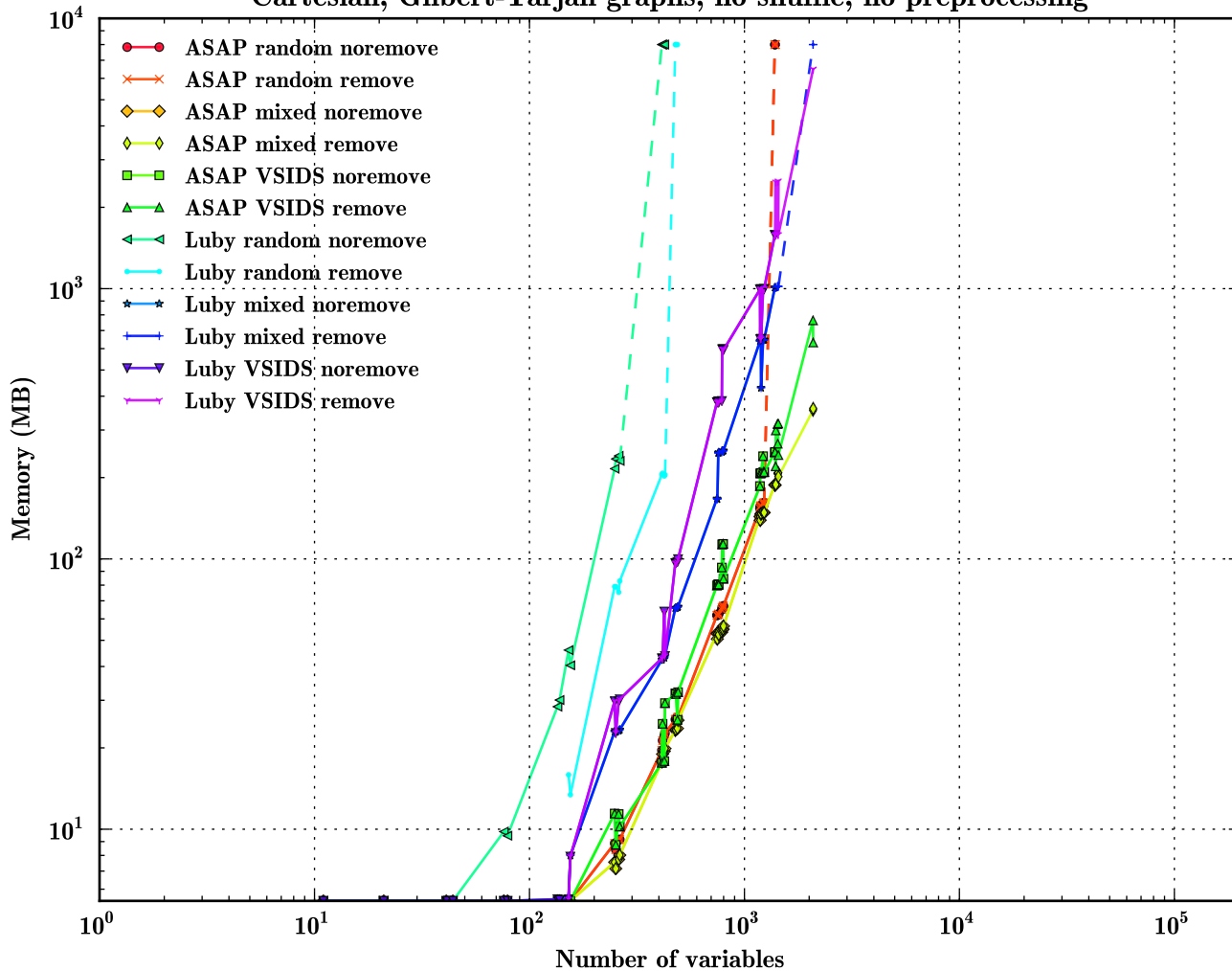
Pebbling formulas, width 5 chain graphs, substitution neq 3, shuffle, preprocessing





# Cartesian products of vanilla pebbling formulas

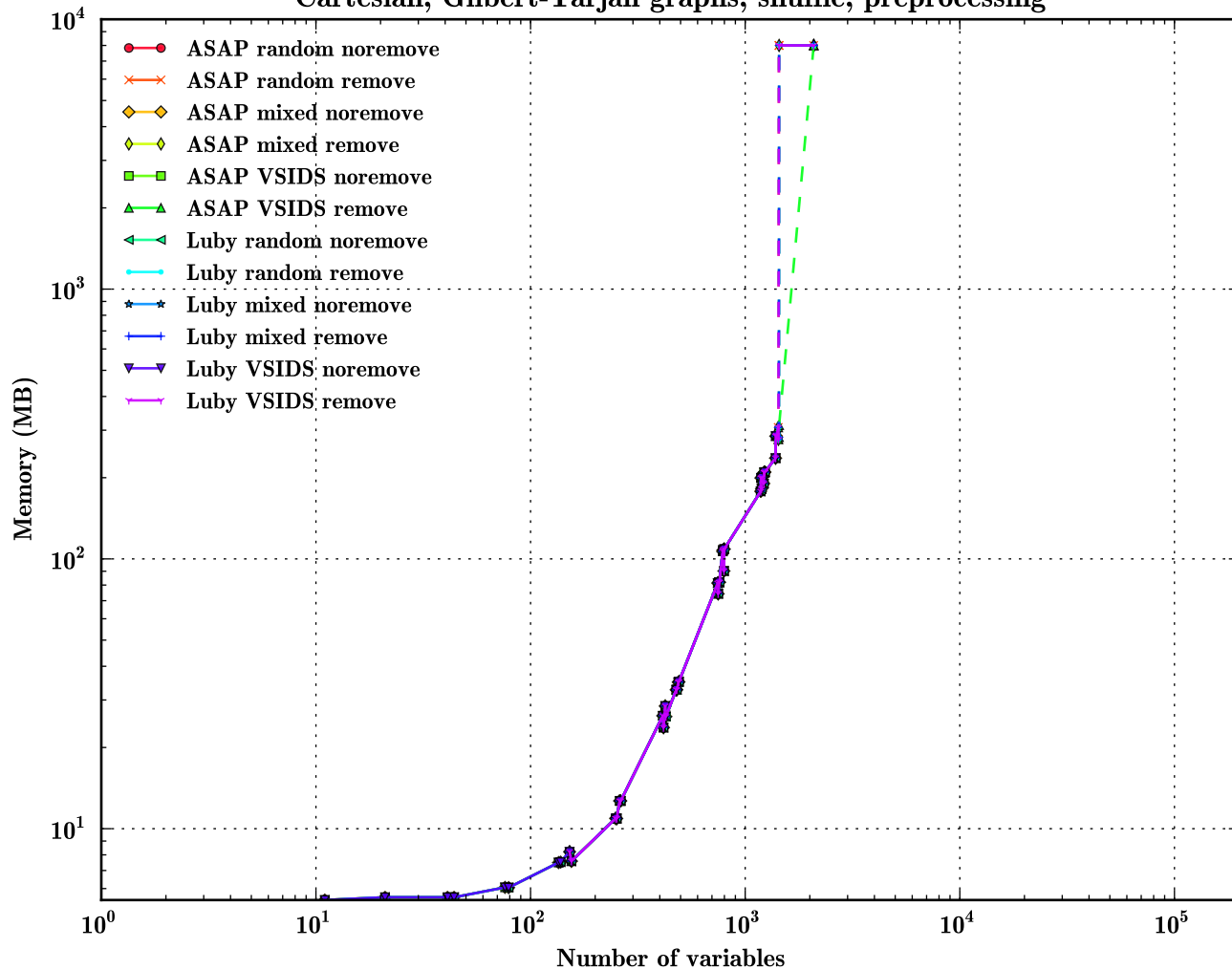
Cartesian, Gilbert-Tarjan graphs, no shuffle, no preprocessing







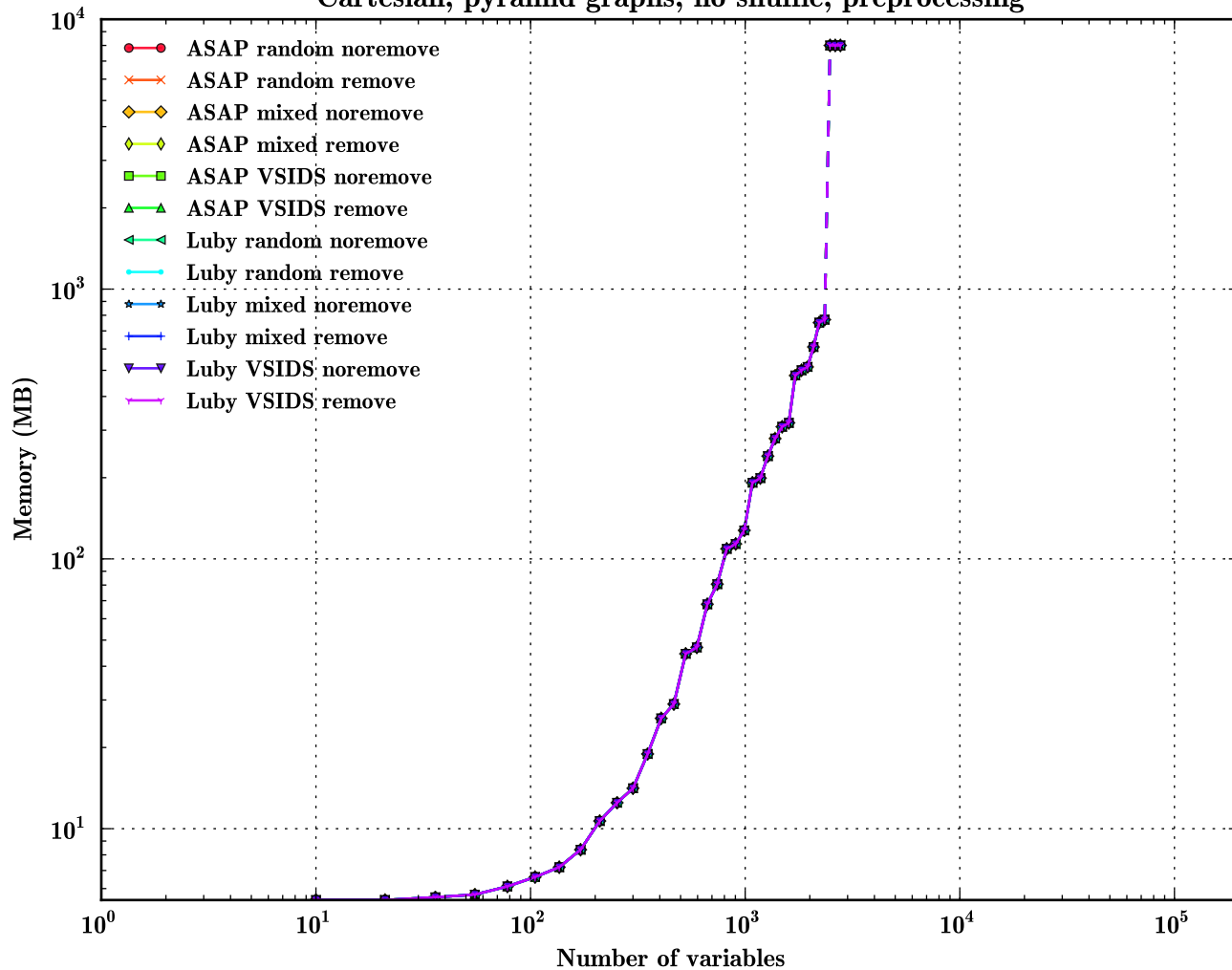
Cartesian, Gilbert-Tarjan graphs, shuffle, preprocessing





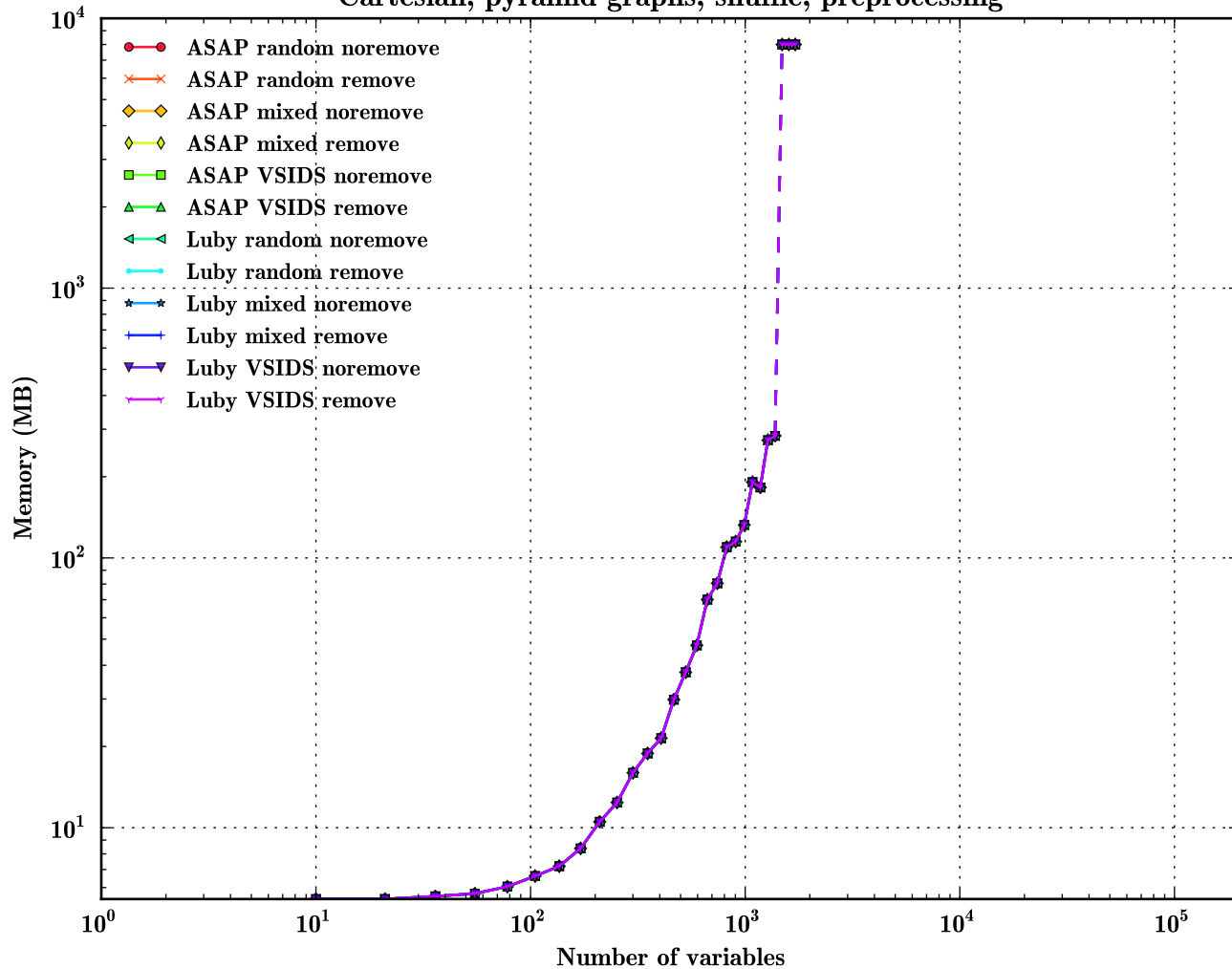


Cartesian, pyramid graphs, no shuffle, preprocessing



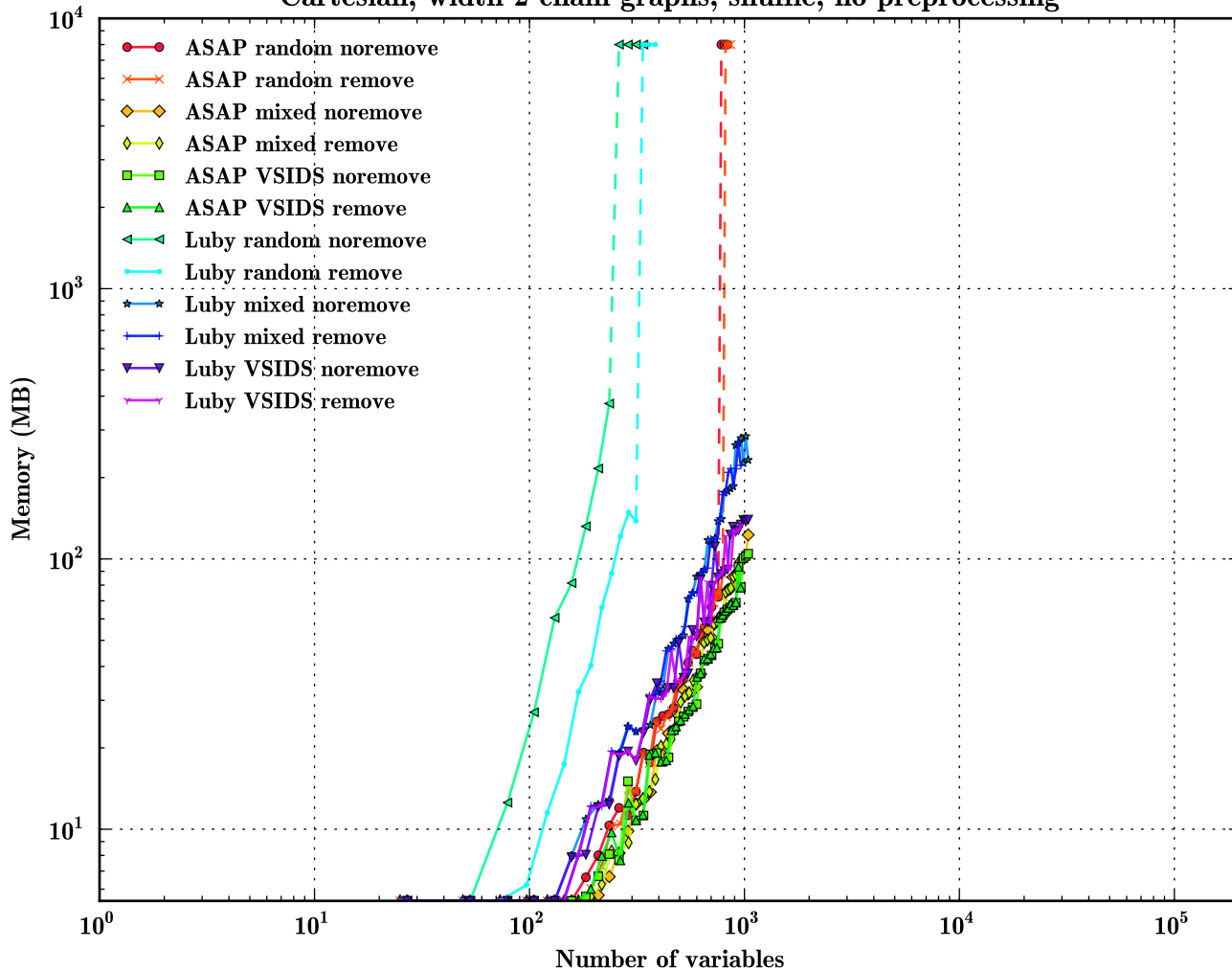


# Cartesian, pyramid graphs, shuffle, preprocessing

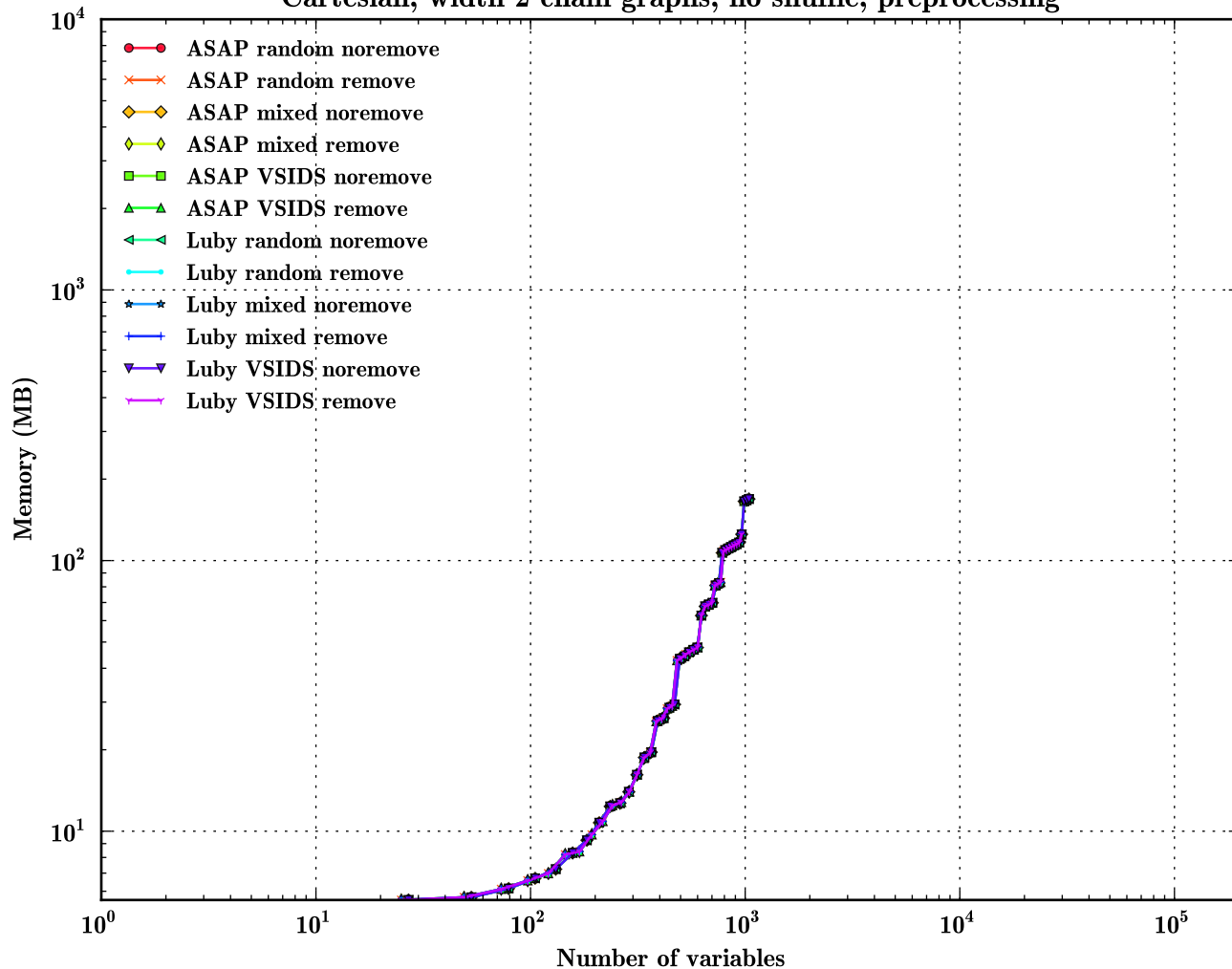




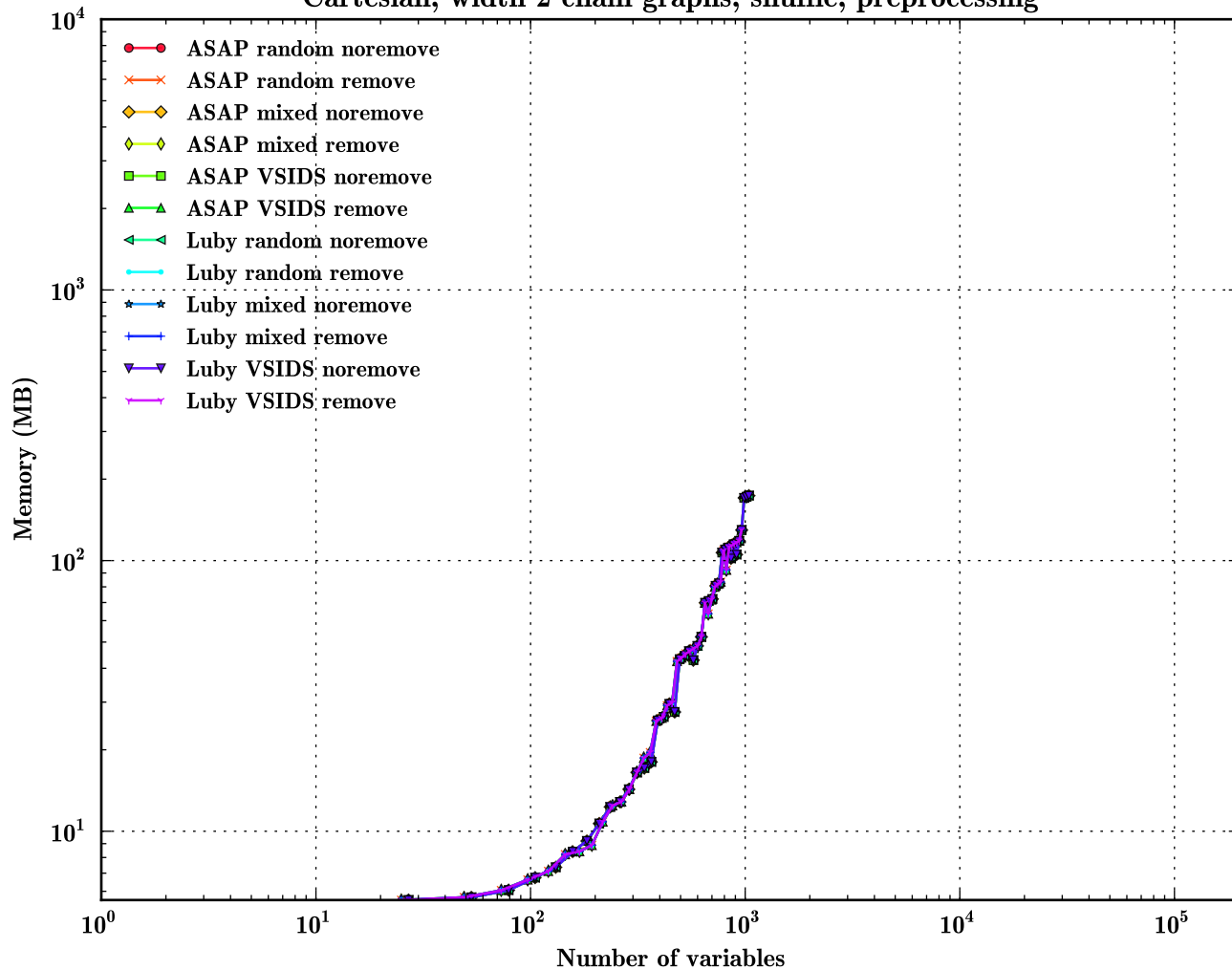
Cartesian, width 2 chain graphs, shuffle, no preprocessing



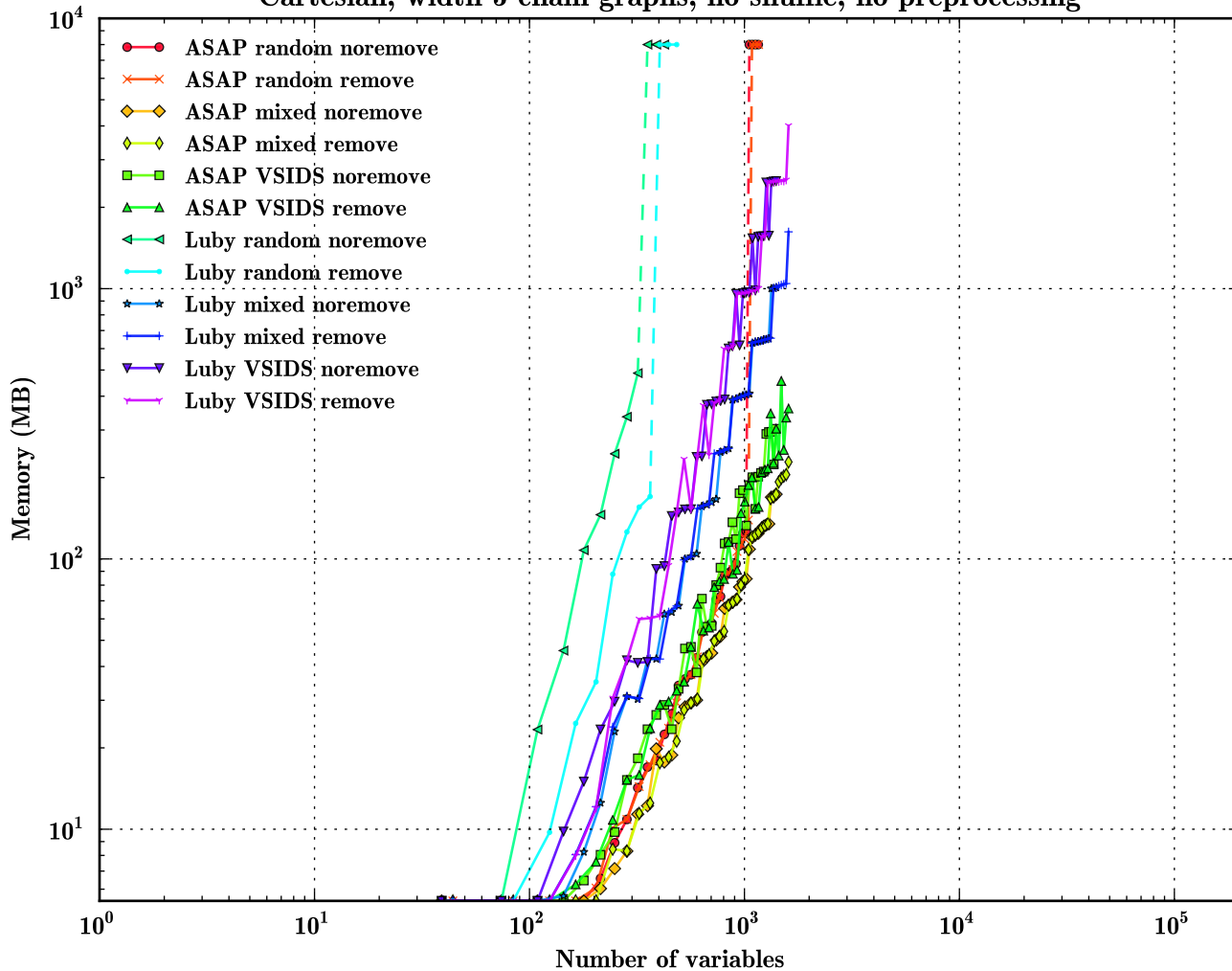
Cartesian, width 2 chain graphs, no shuffle, preprocessing



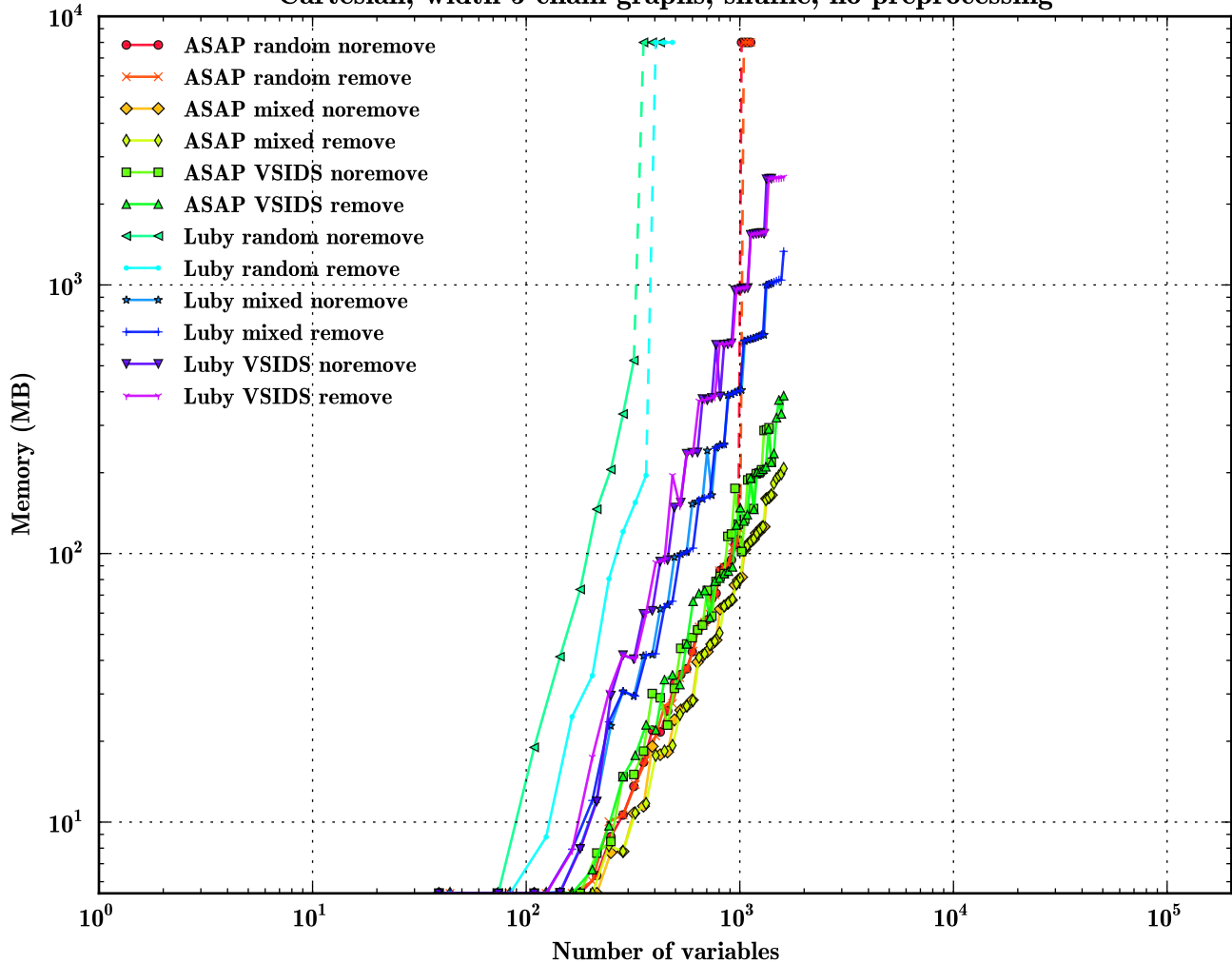
Cartesian, width 2 chain graphs, shuffle, preprocessing



Cartesian, width 5 chain graphs, no shuffle, no preprocessing



Cartesian, width 5 chain graphs, shuffle, no preprocessing



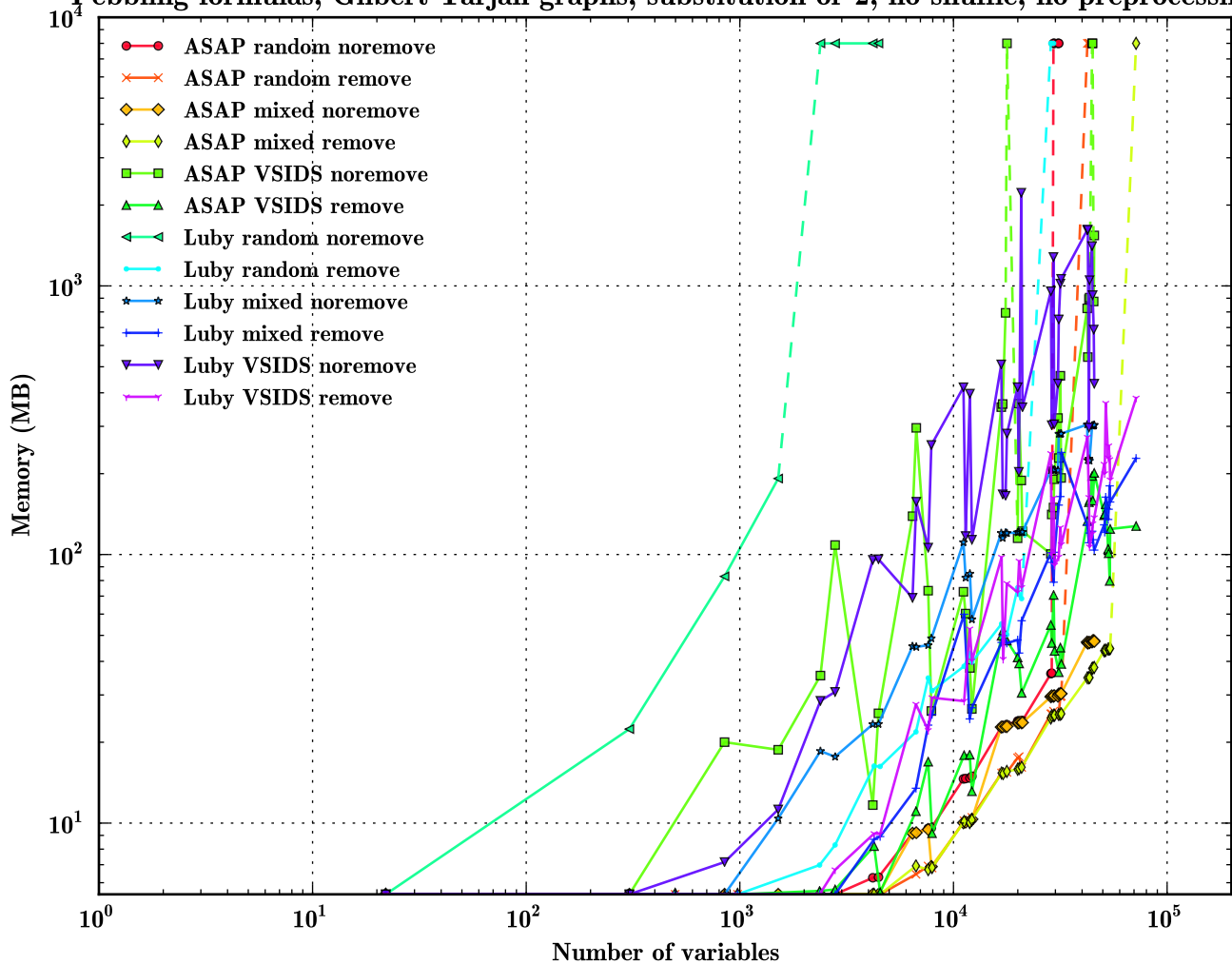




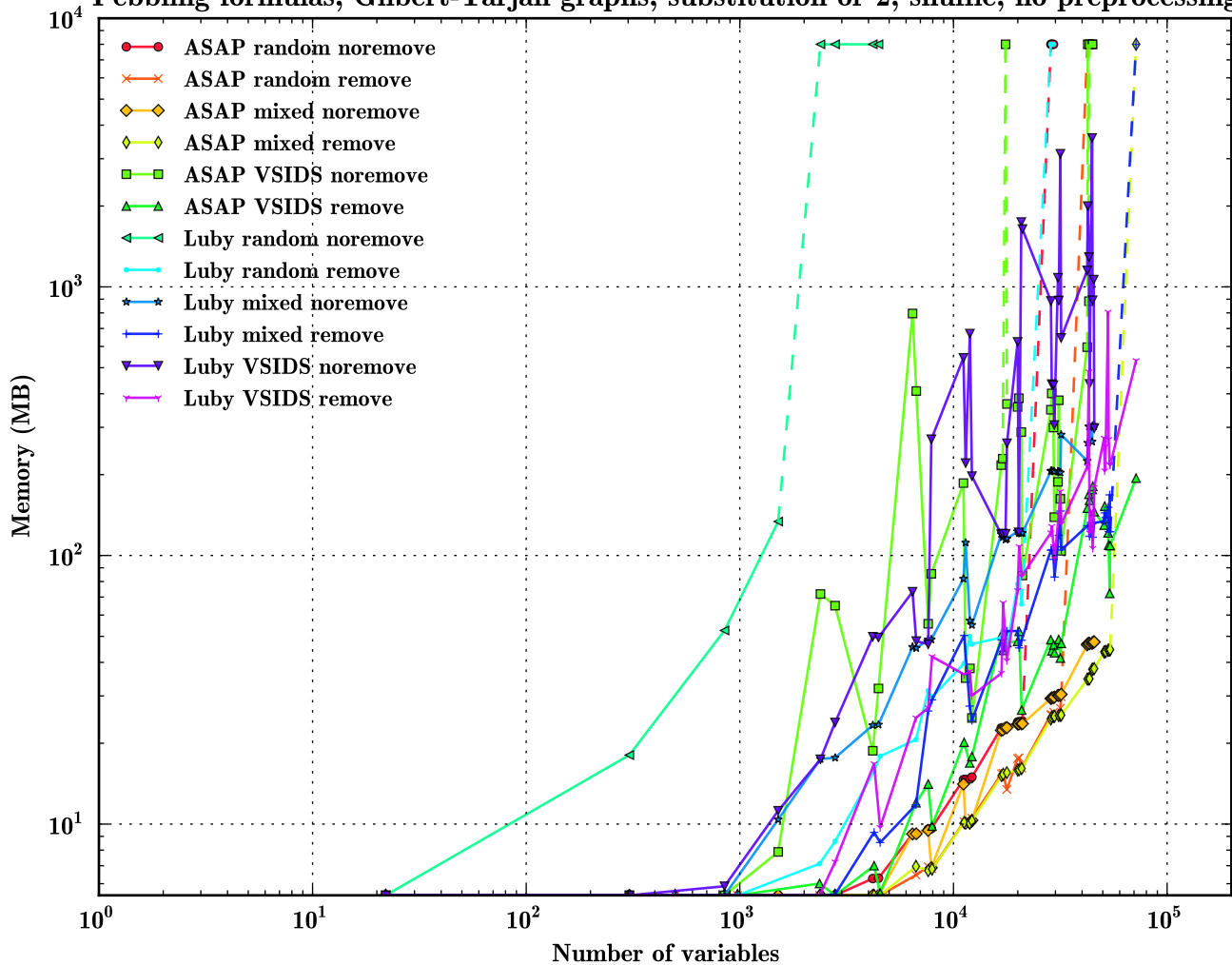


# **Pebbling formulas with substitution or of arity 2**

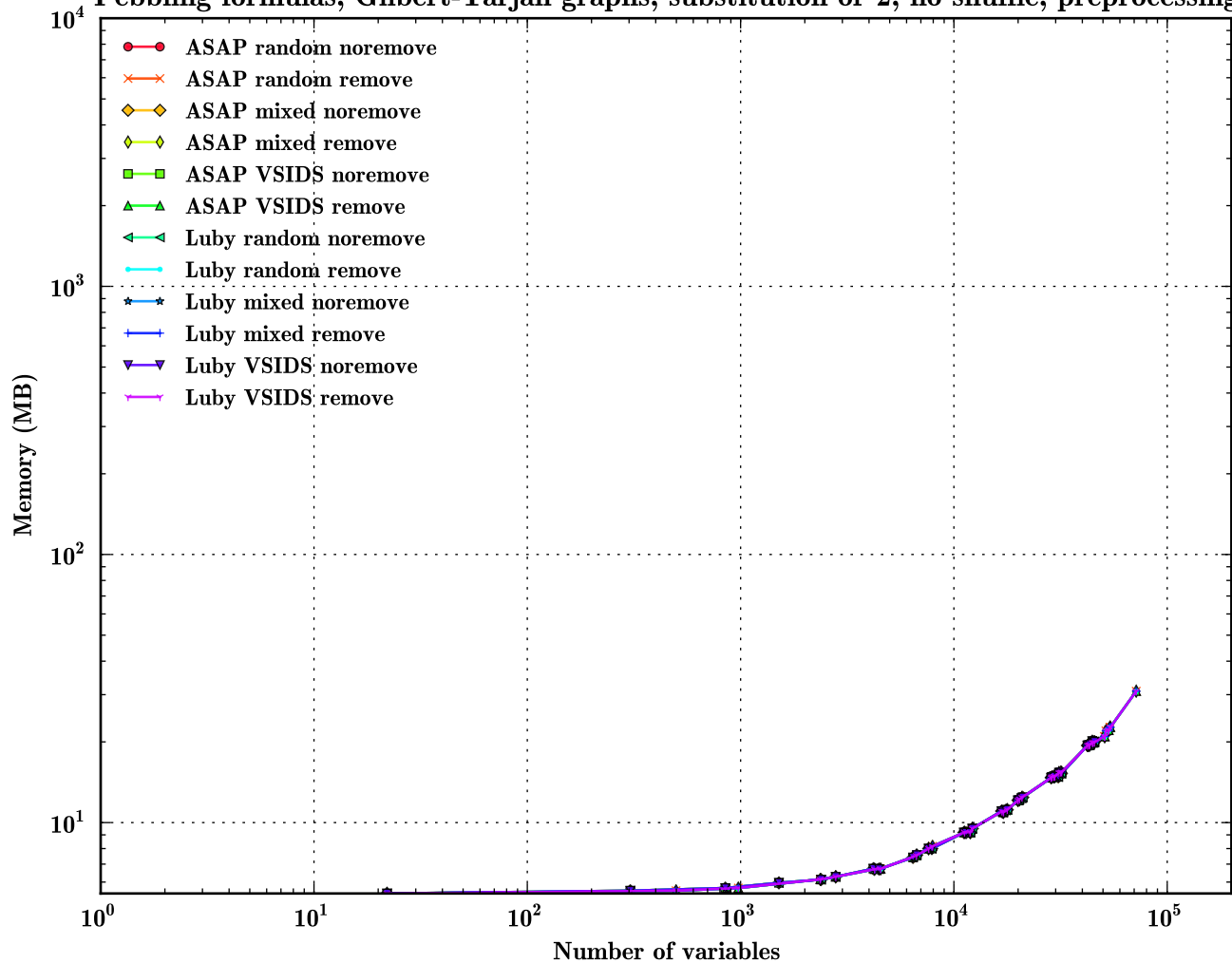
Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, no shuffle, no preprocessing



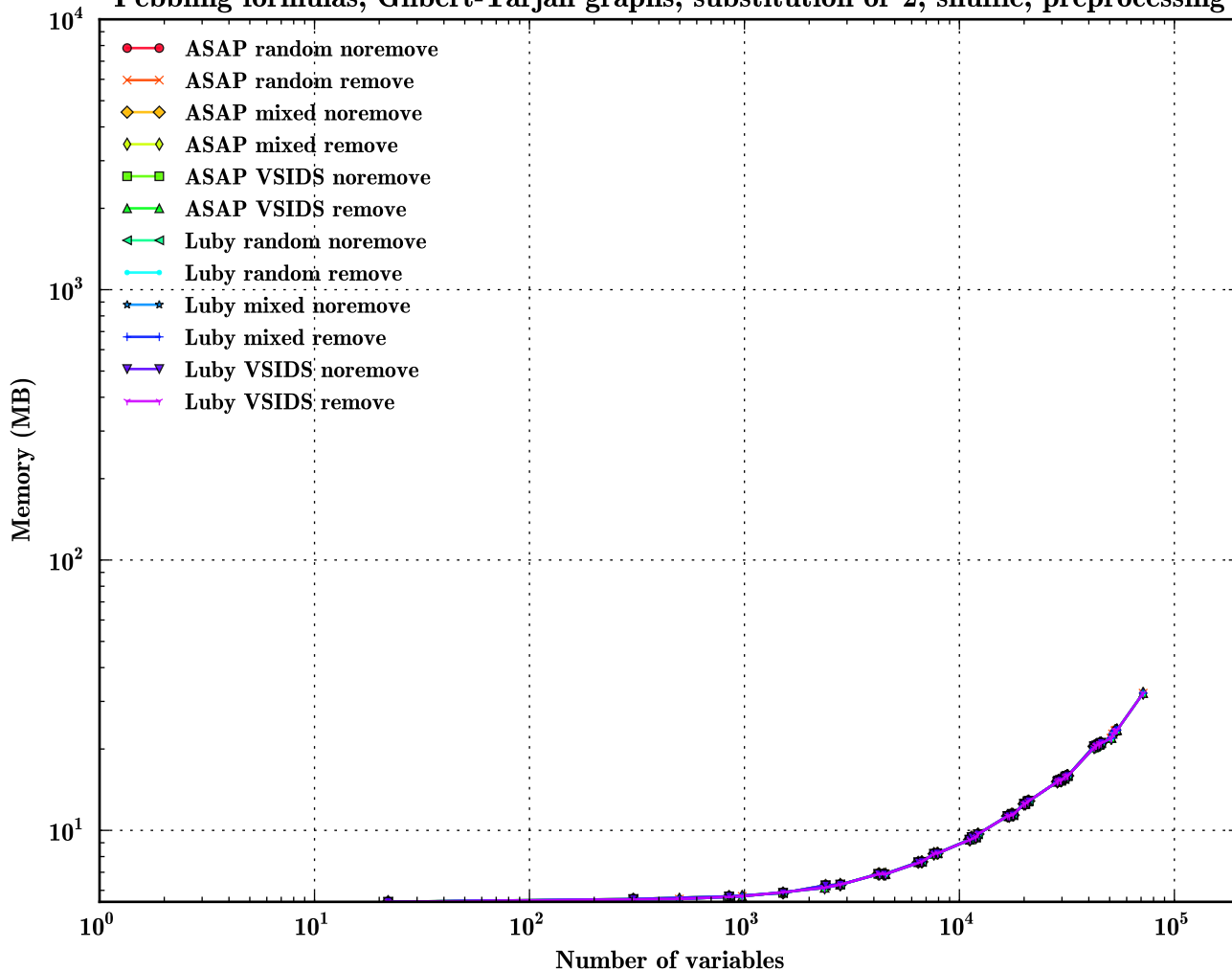
# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, shuffle, no preprocessing



# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, no shuffle, preprocessing

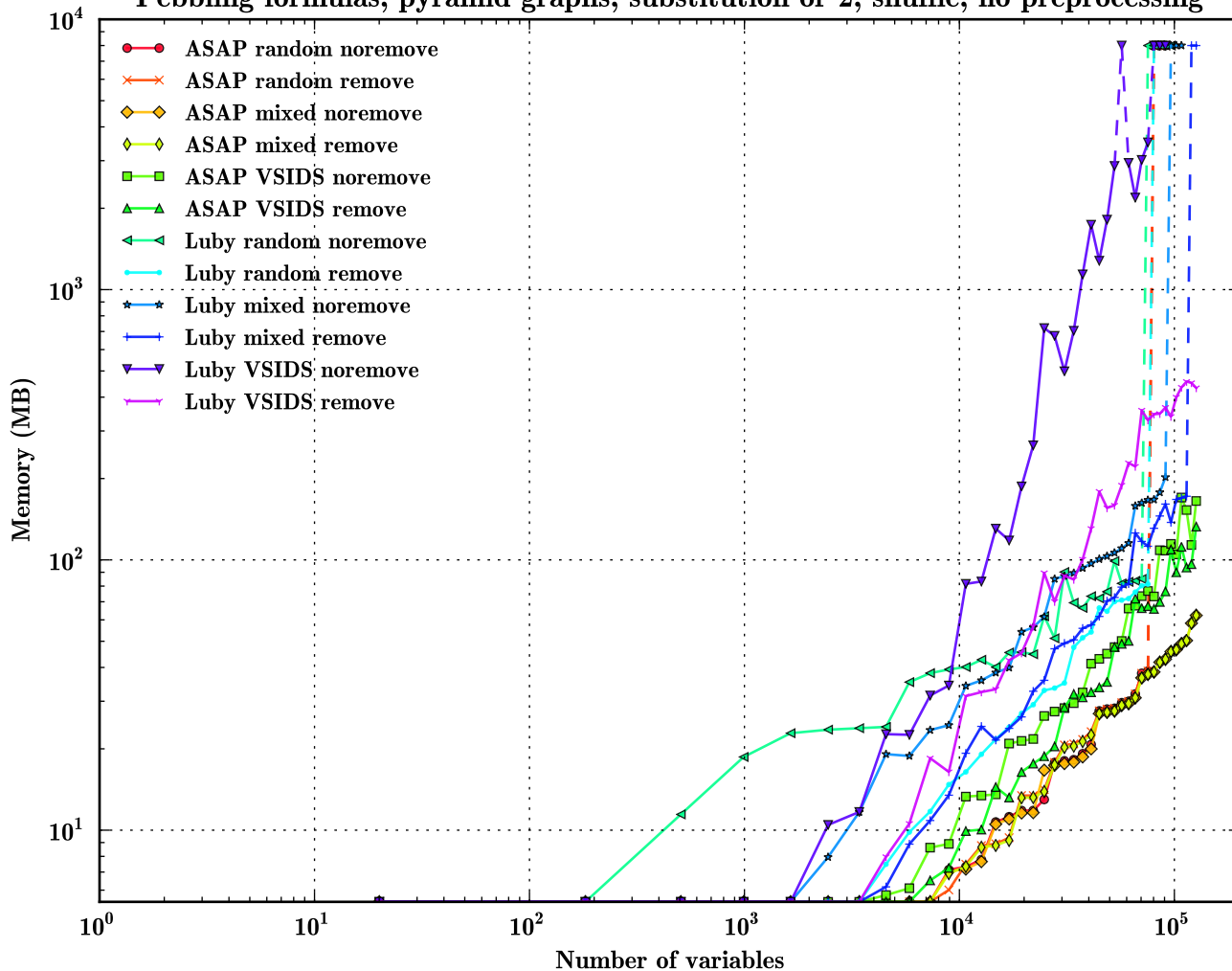


# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, shuffle, preprocessing



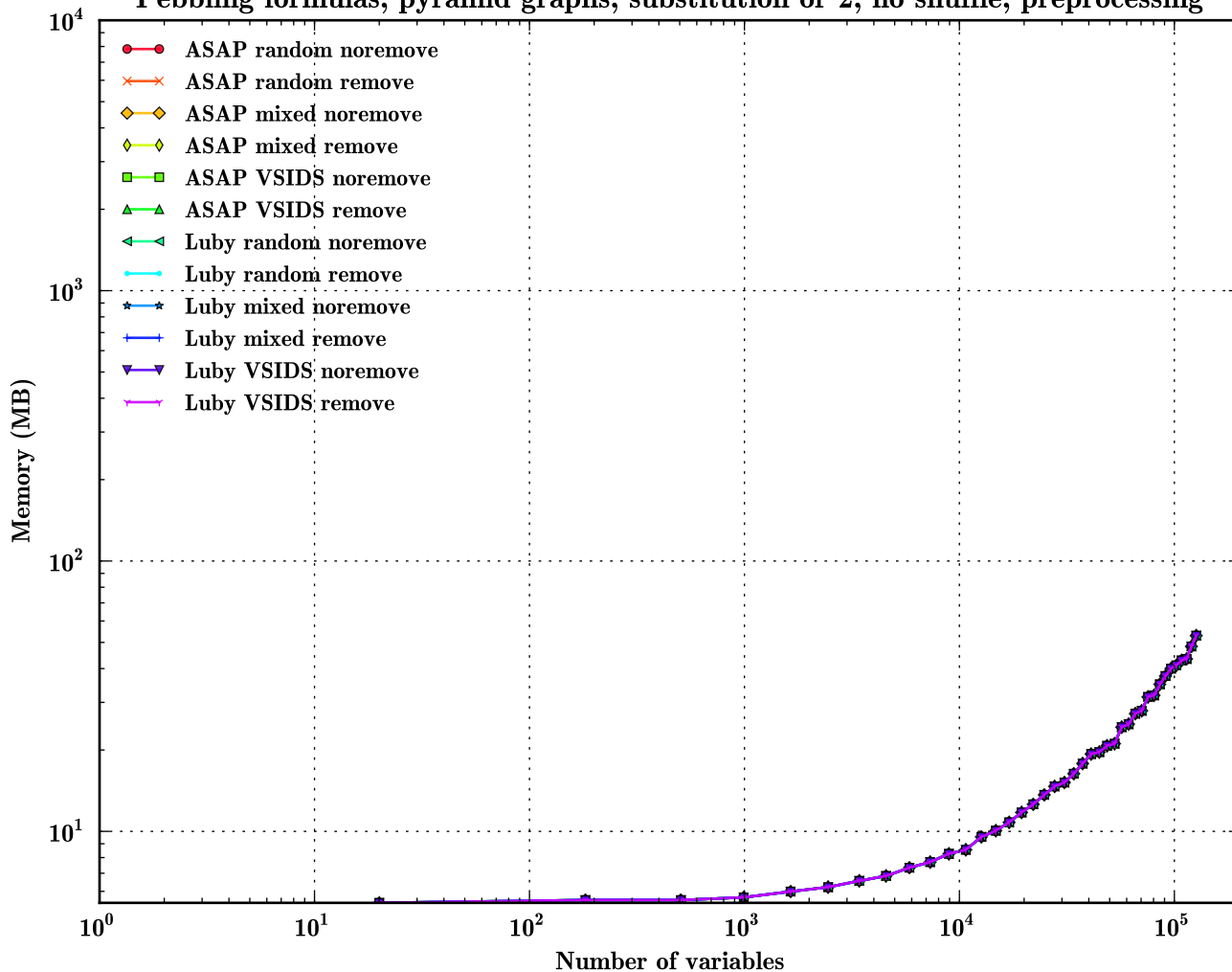


Pebbling formulas, pyramid graphs, substitution or 2, shuffle, no preprocessing

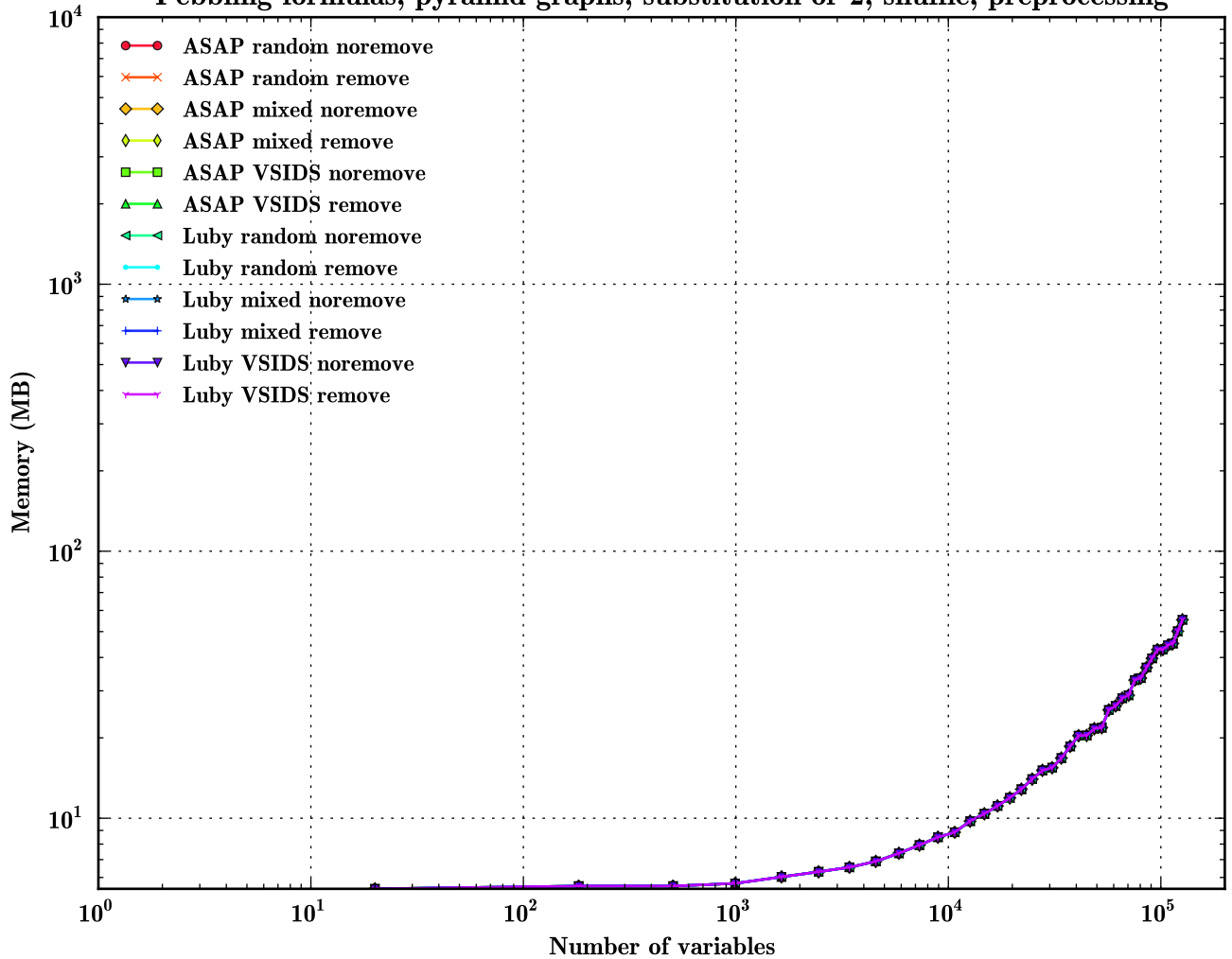




# Pebbling formulas, pyramid graphs, substitution or 2, no shuffle, preprocessing

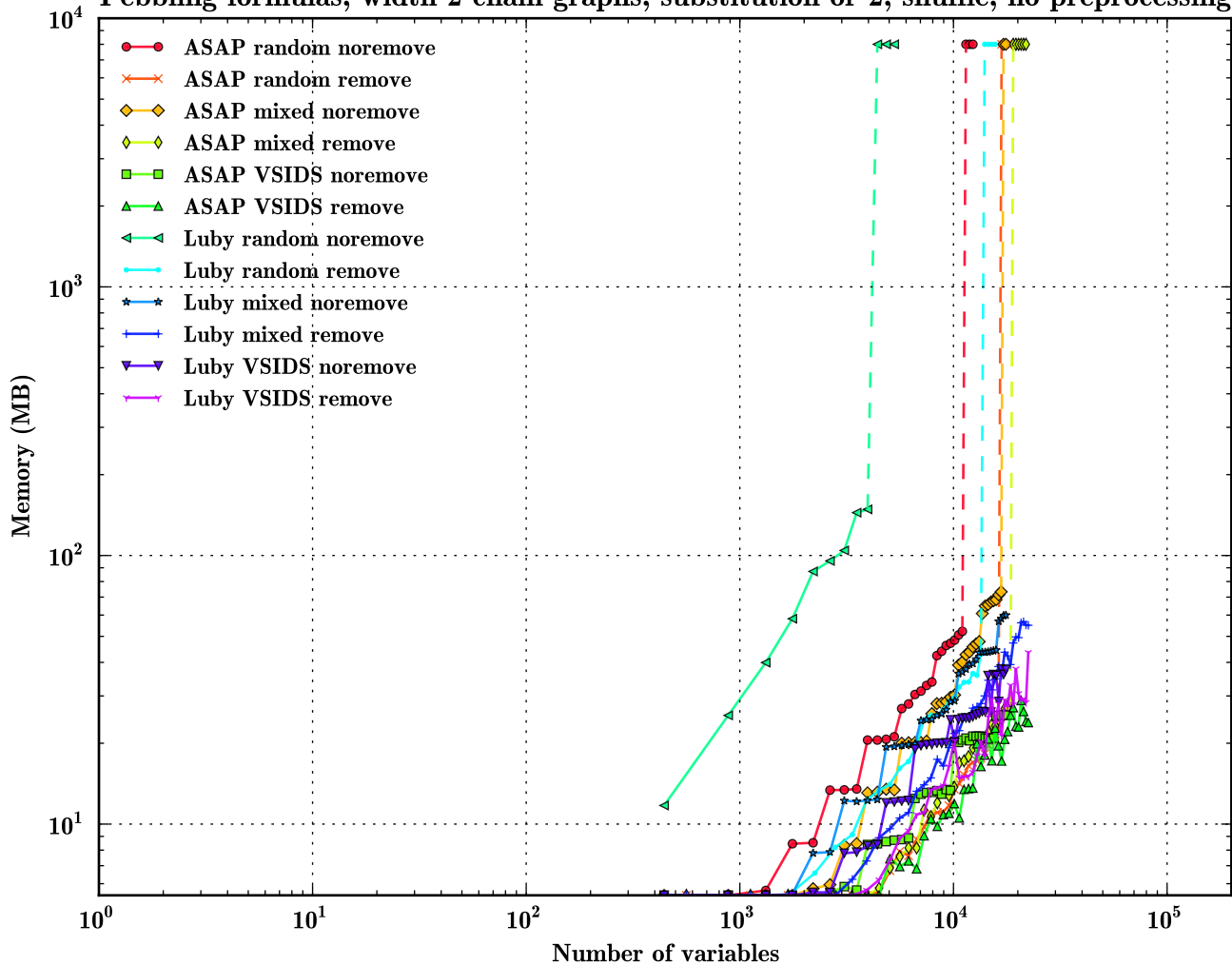


# Pebbling formulas, pyramid graphs, substitution or 2, shuffle, preprocessing

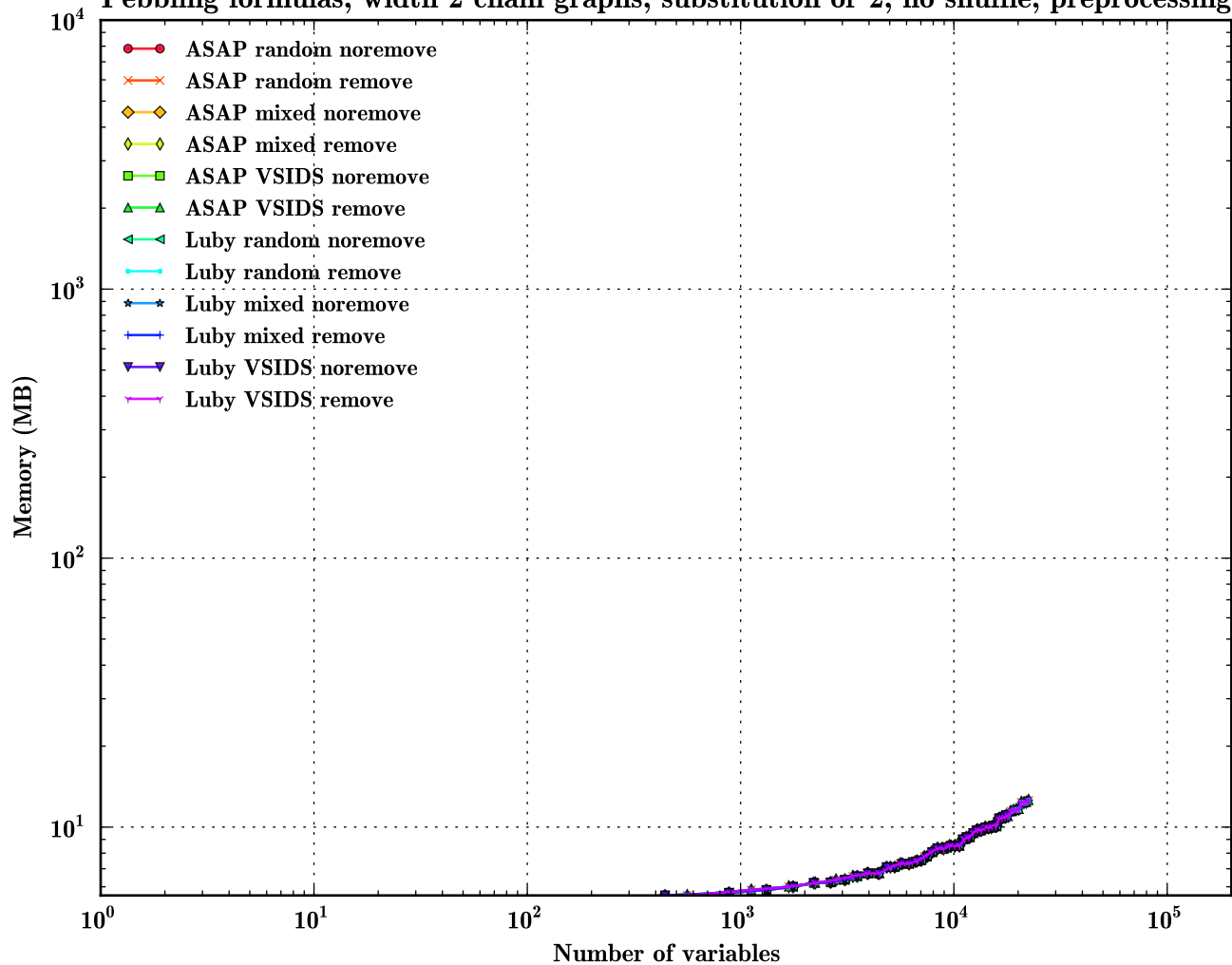




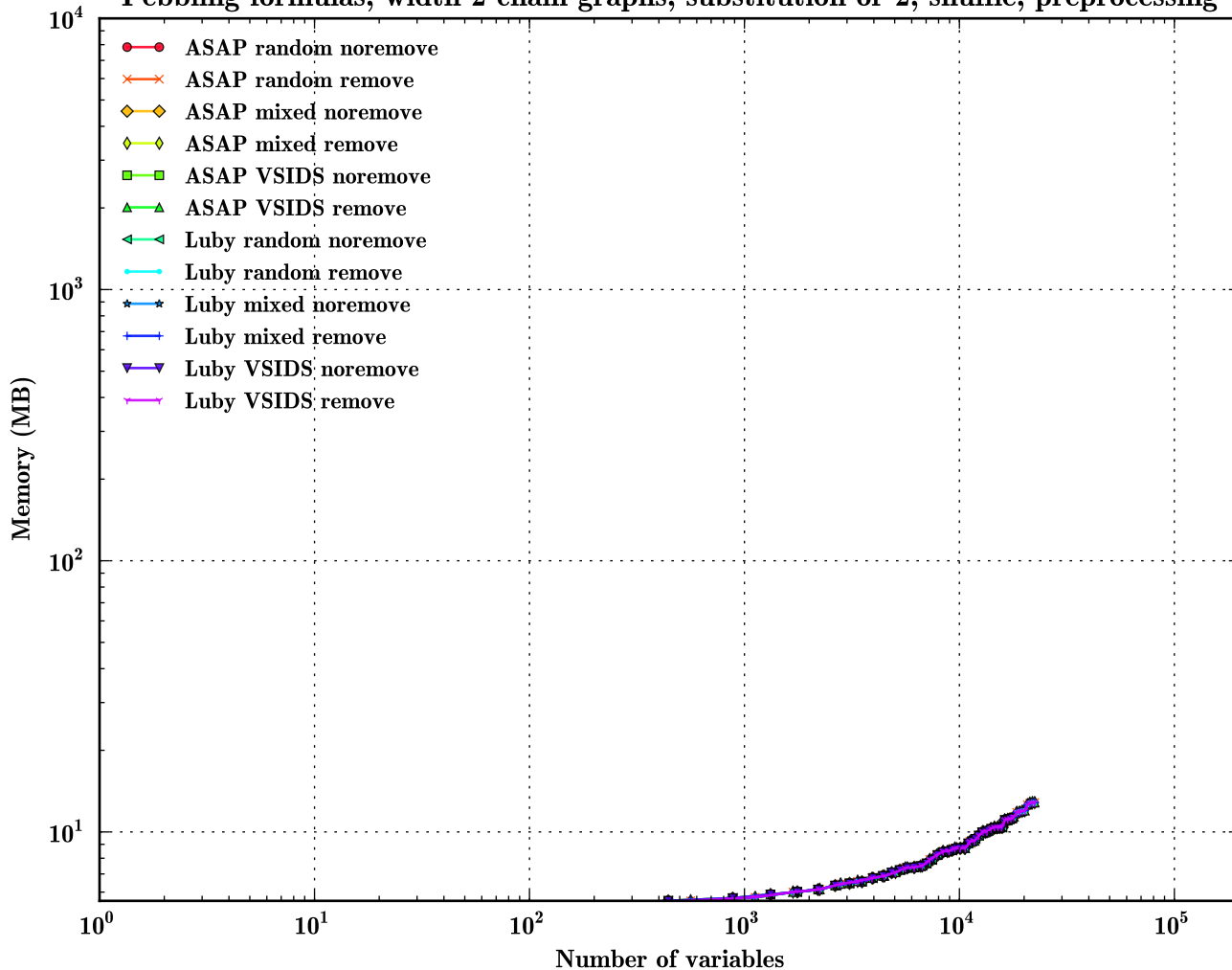
# Pebbling formulas, width 2 chain graphs, substitution or 2, shuffle, no preprocessing



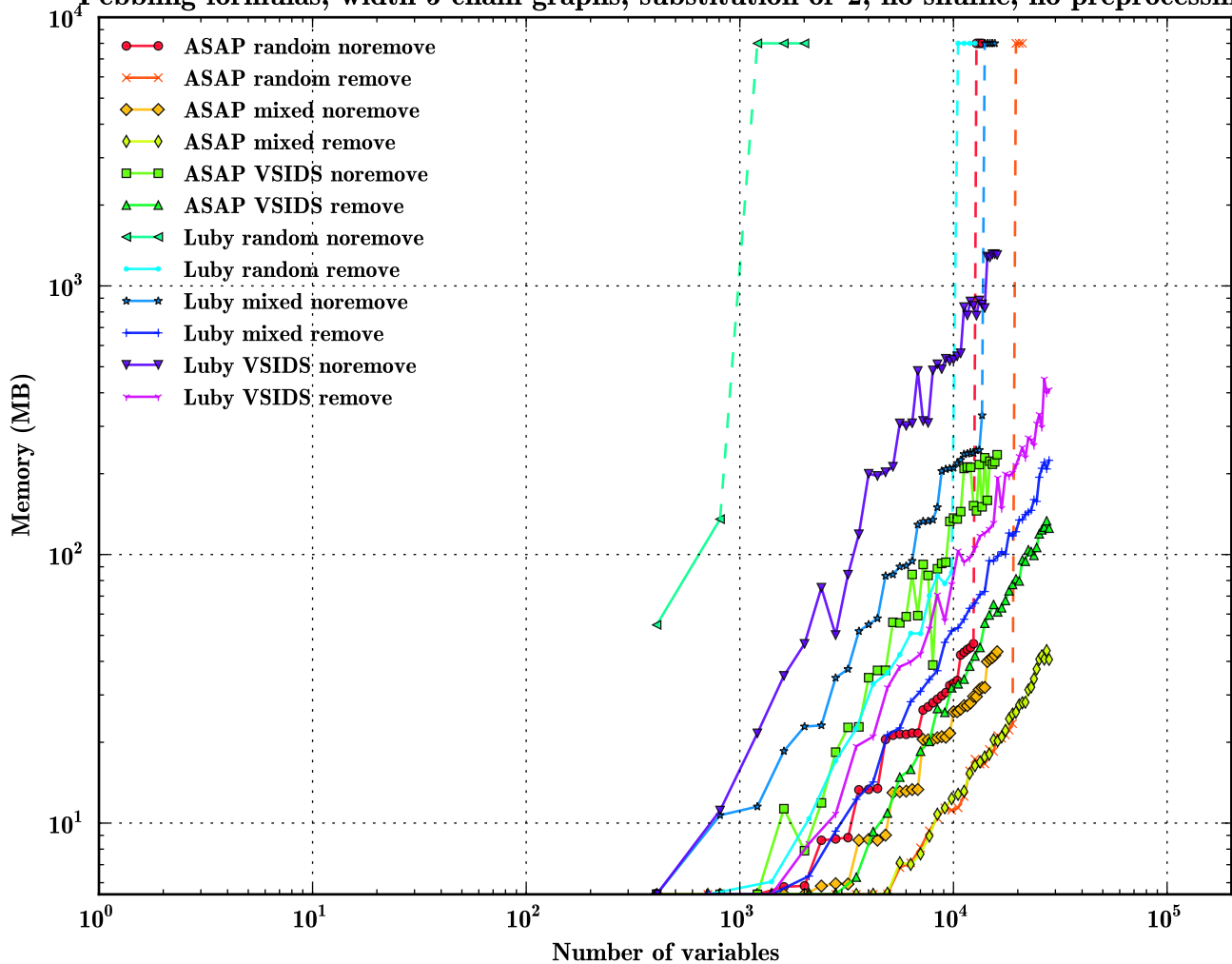
Pebbling formulas, width 2 chain graphs, substitution or 2, no shuffle, preprocessing



# Pebbling formulas, width 2 chain graphs, substitution or 2, shuffle, preprocessing



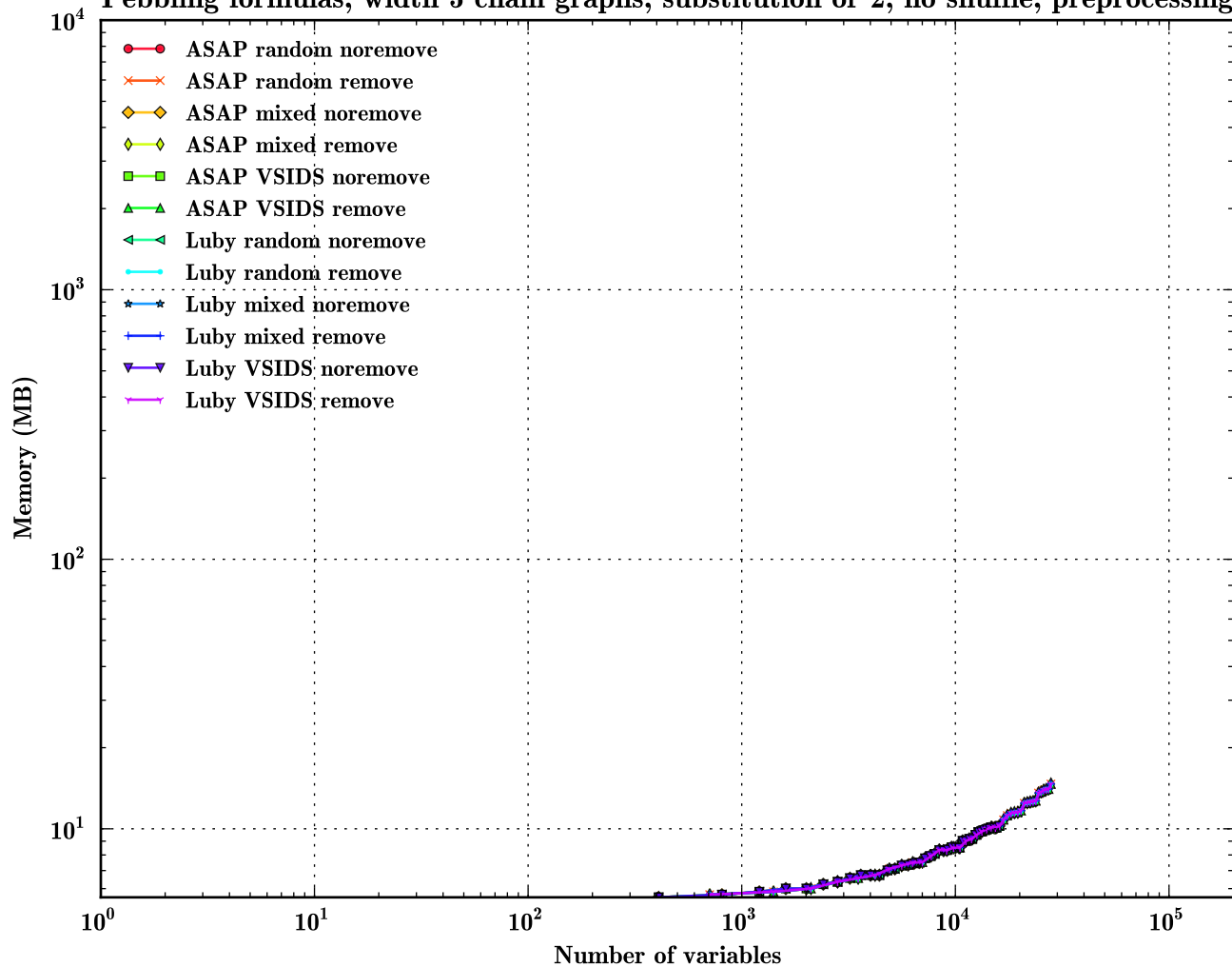
Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, no preprocessing



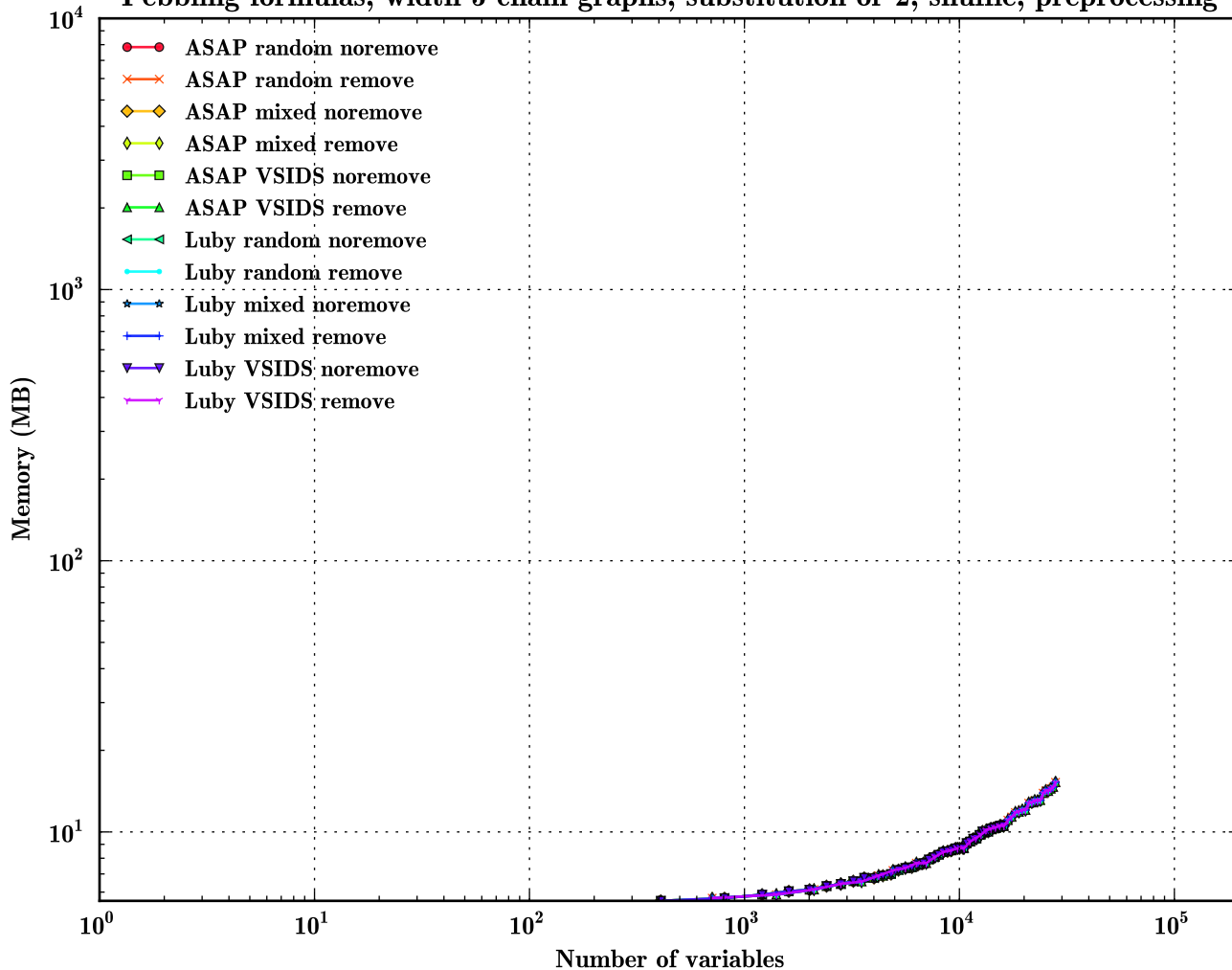




Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, preprocessing

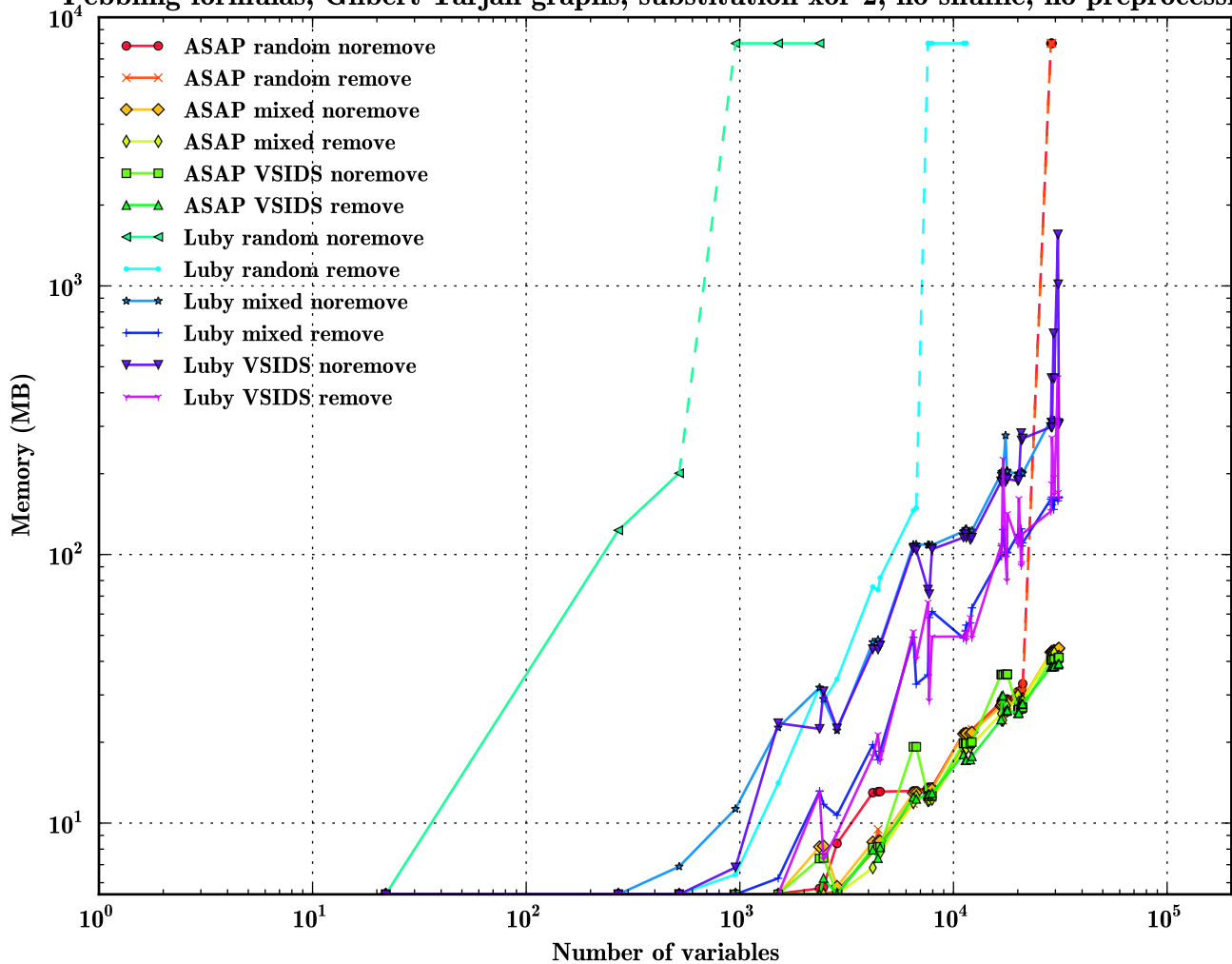


# Pebbling formulas, width 5 chain graphs, substitution or 2, shuffle, preprocessing

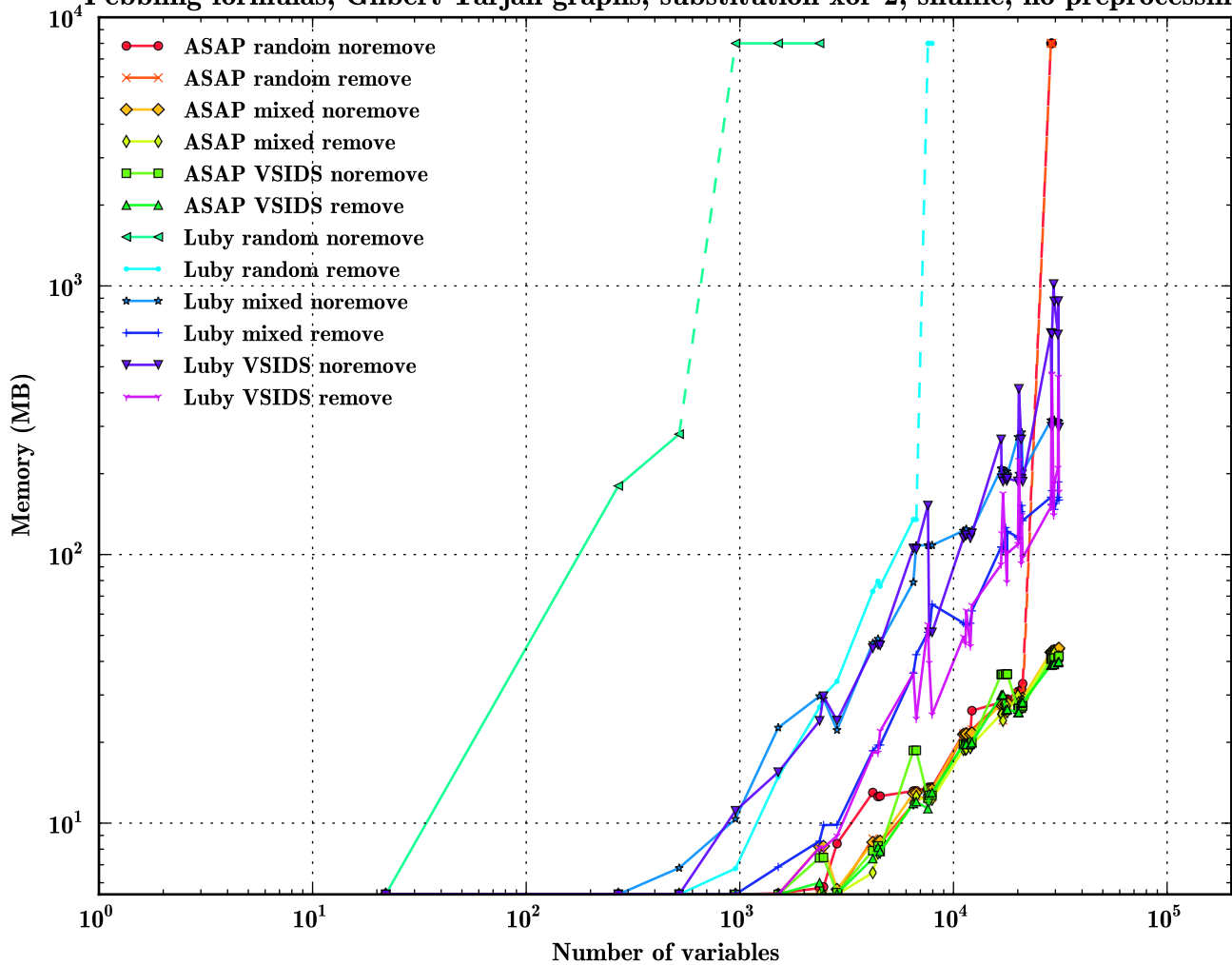


# **Pebbling formulas with substitution xor of arity 2**

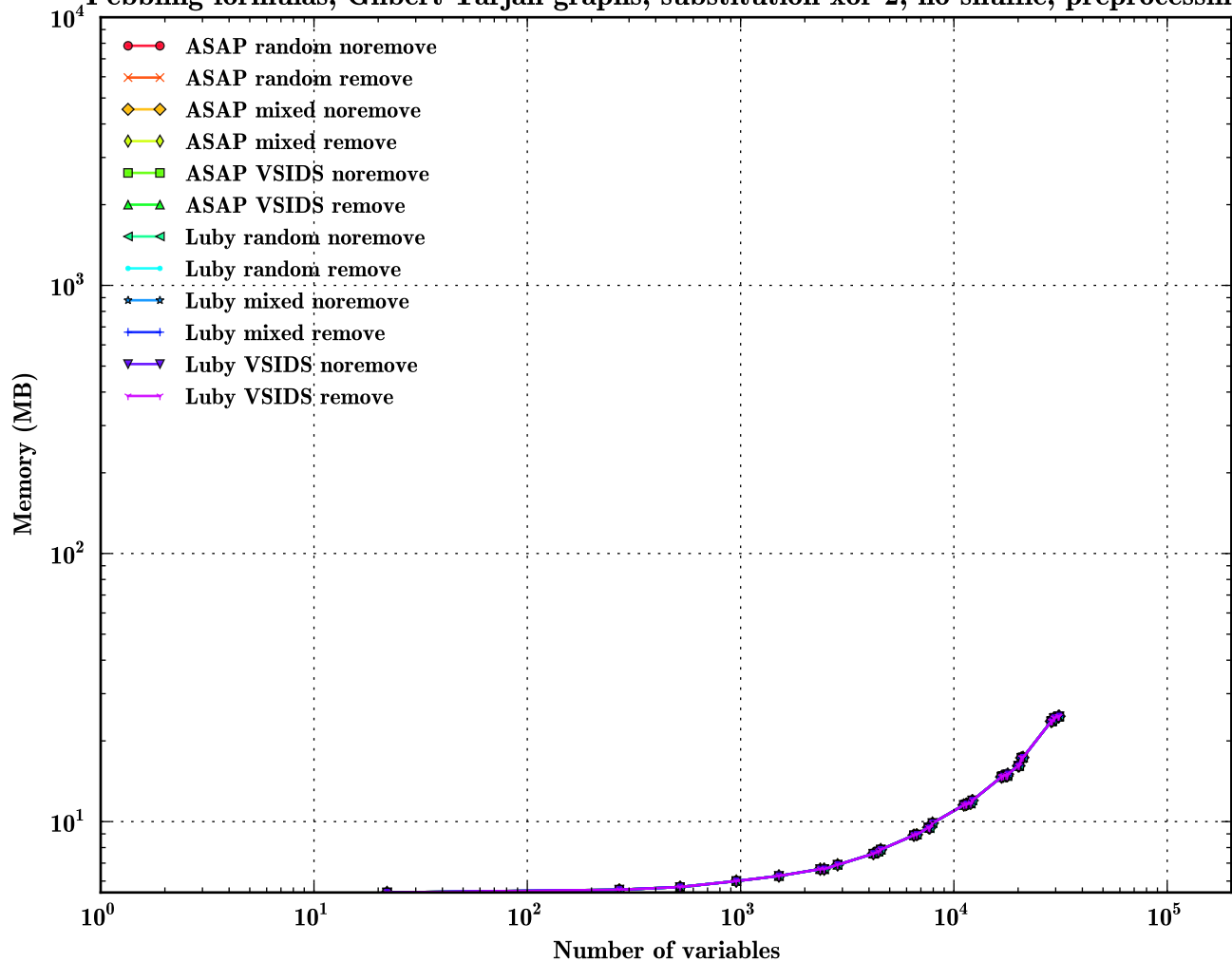
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, no shuffle, no preprocessing



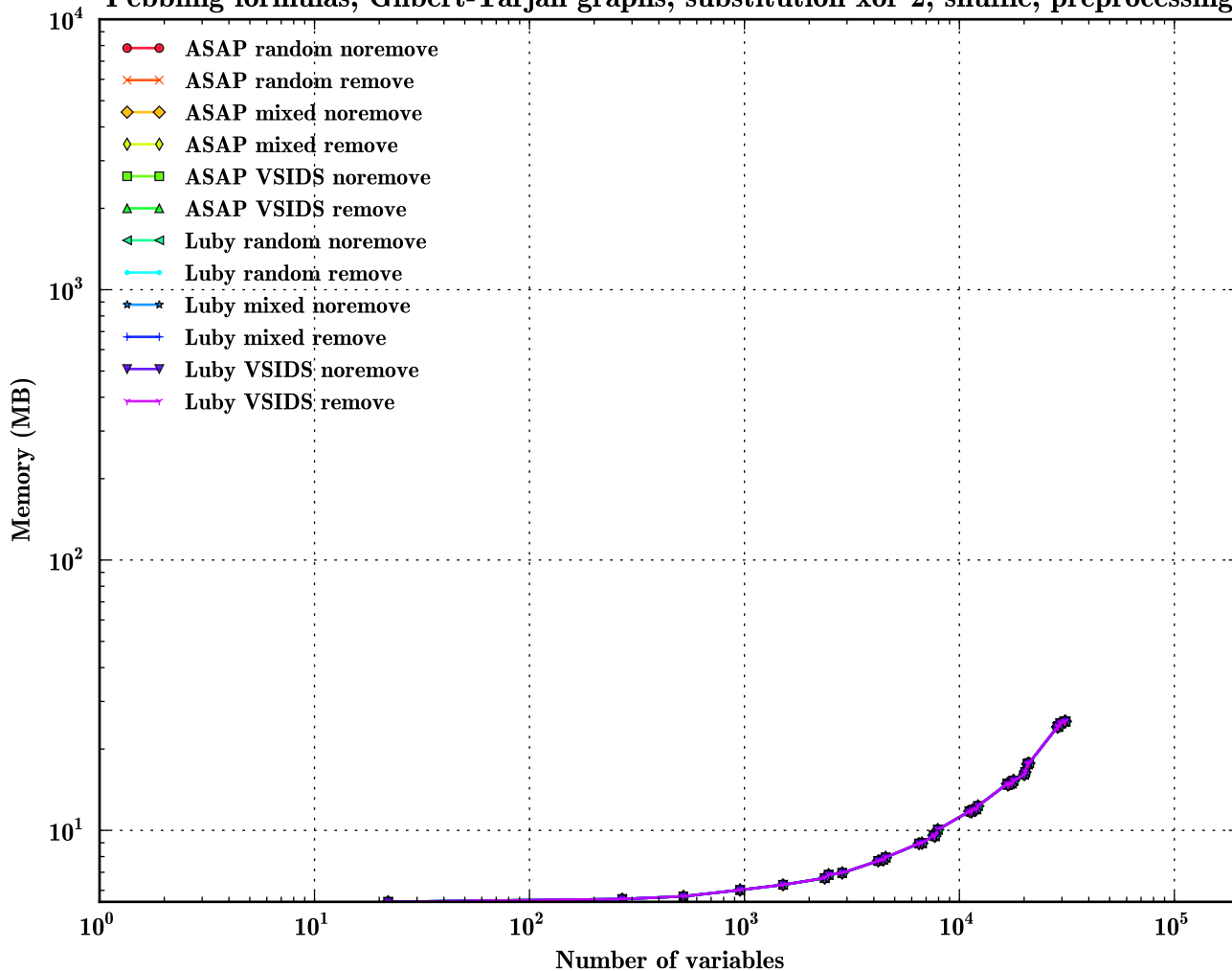
Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, no preprocessing



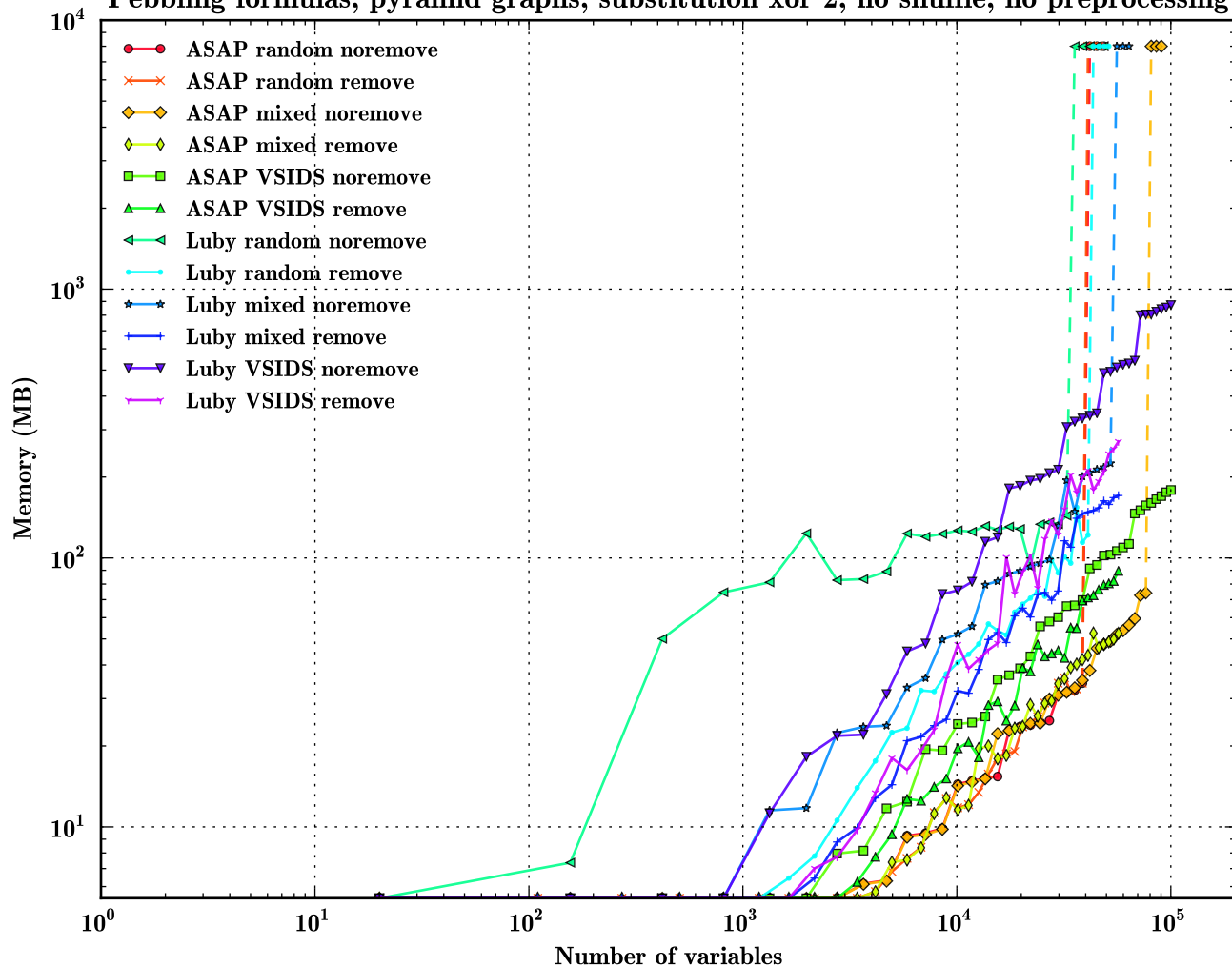
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, no shuffle, preprocessing



# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, preprocessing

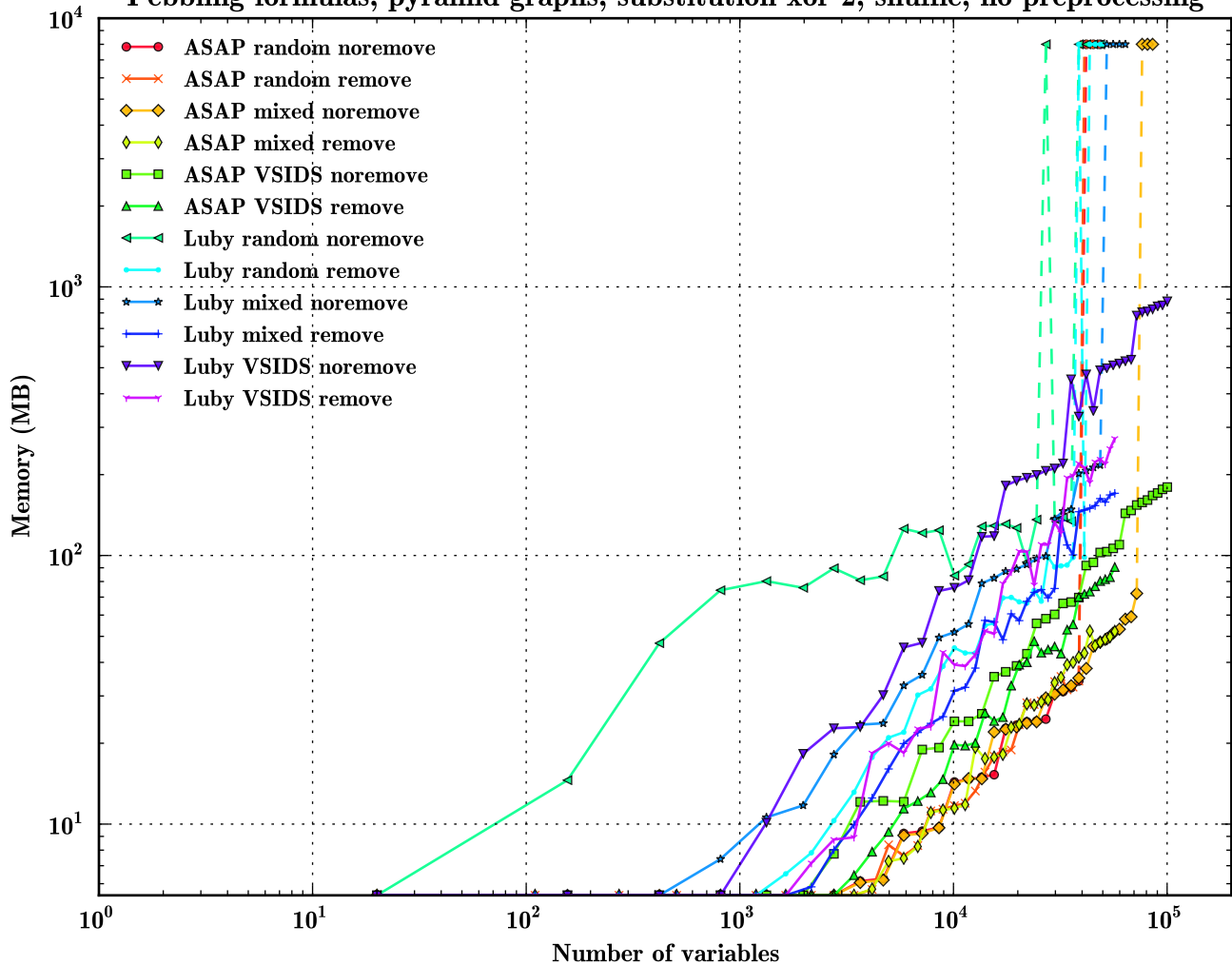


# Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, no preprocessing

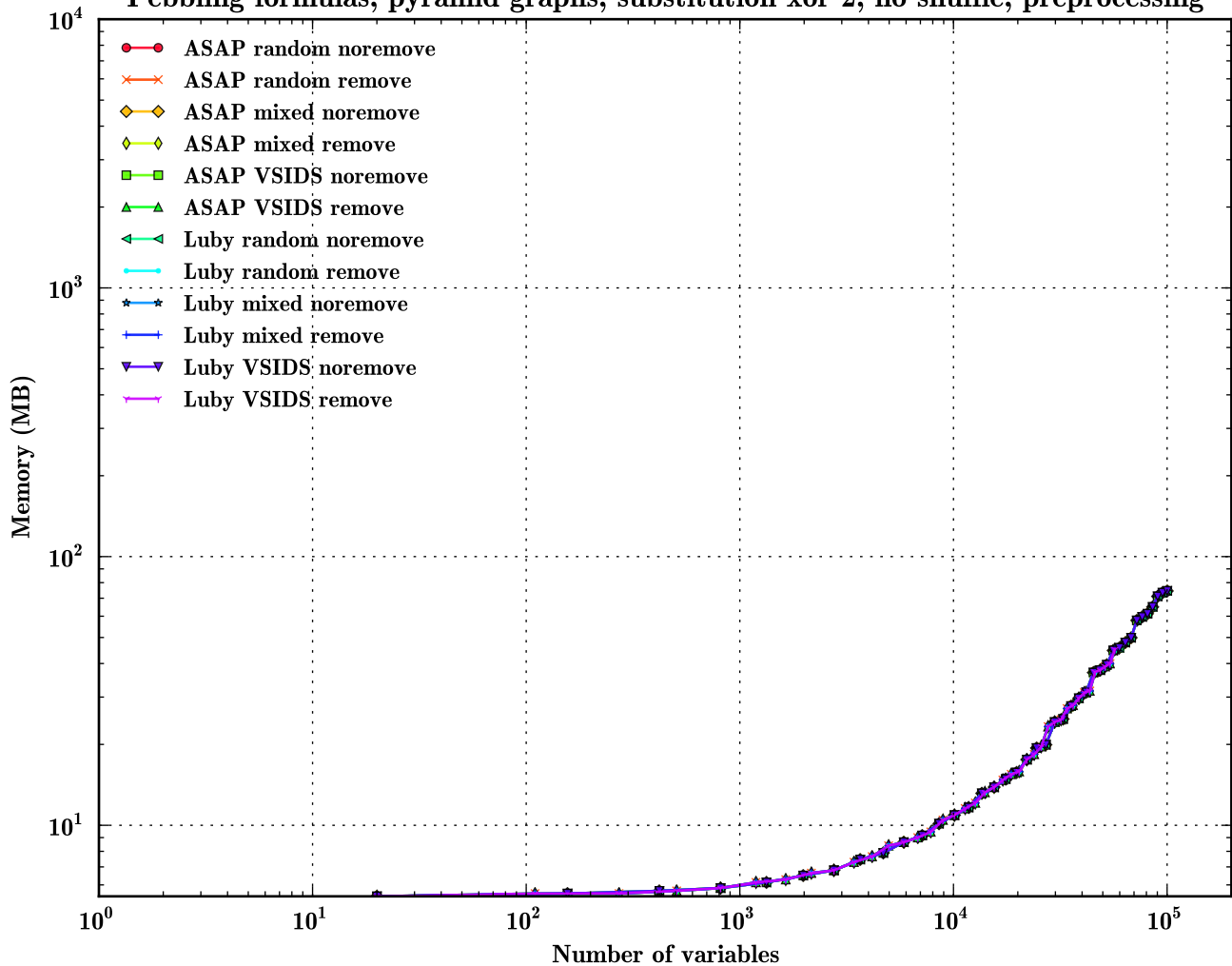




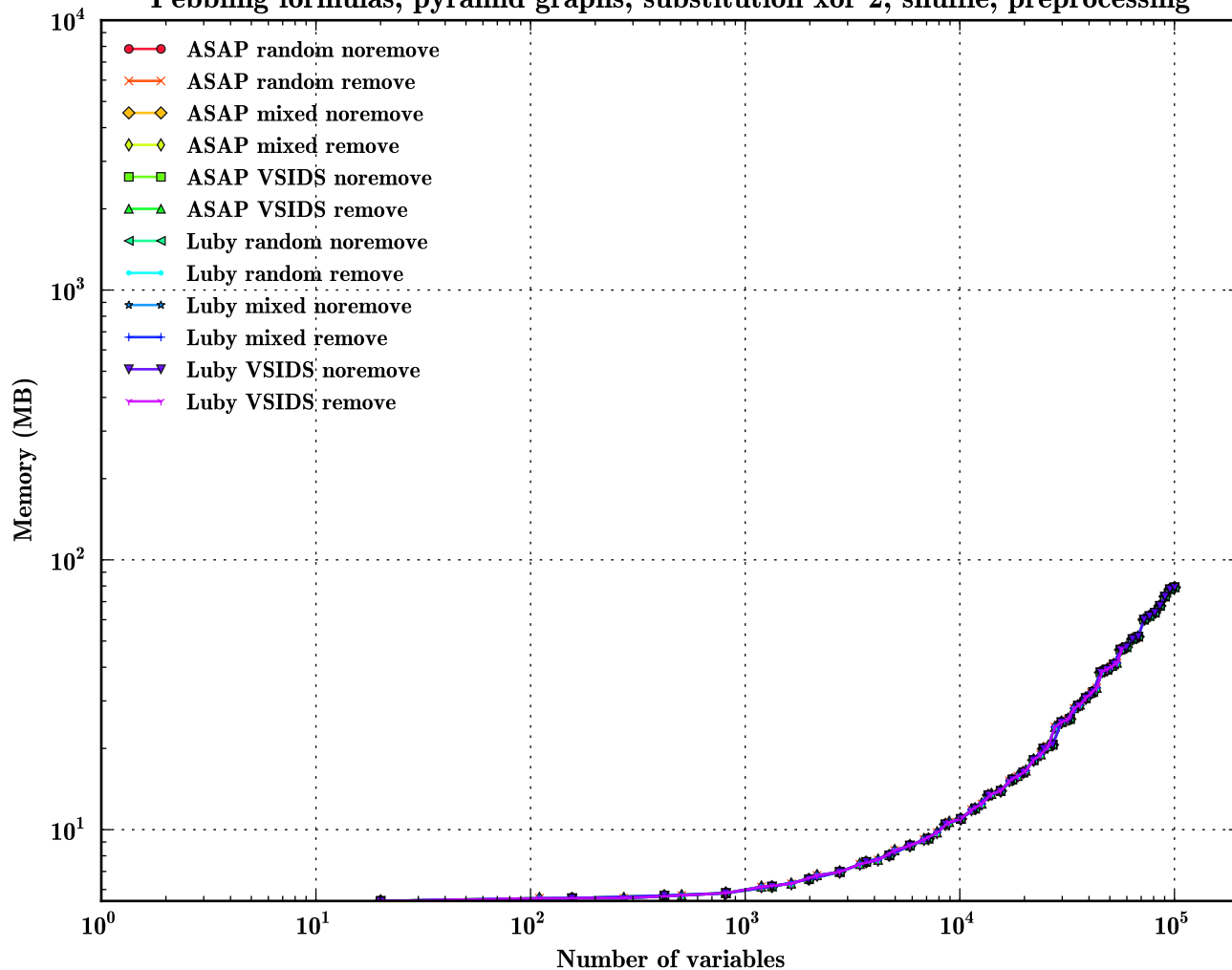
# Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, no preprocessing



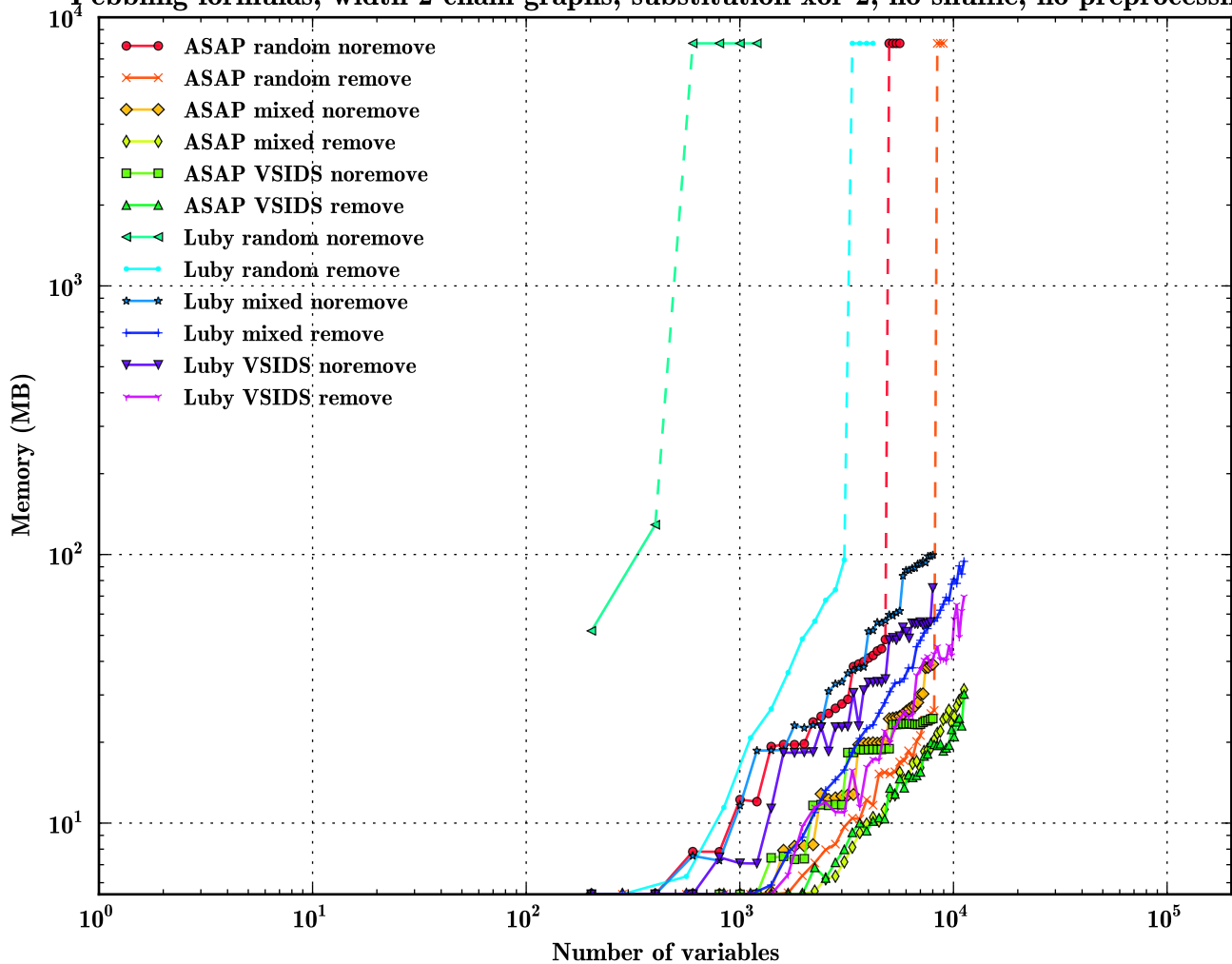
# Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, preprocessing



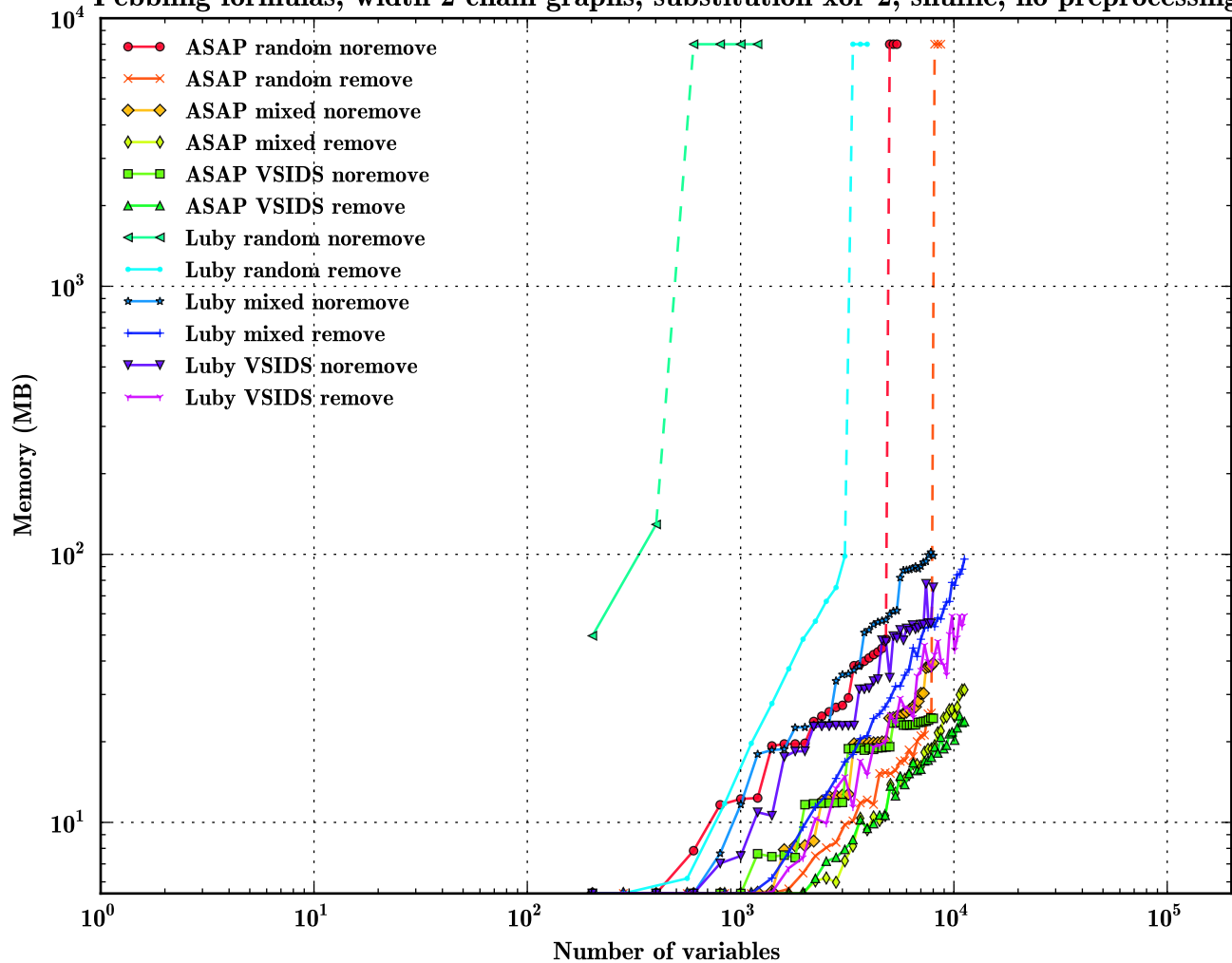
# Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, preprocessing



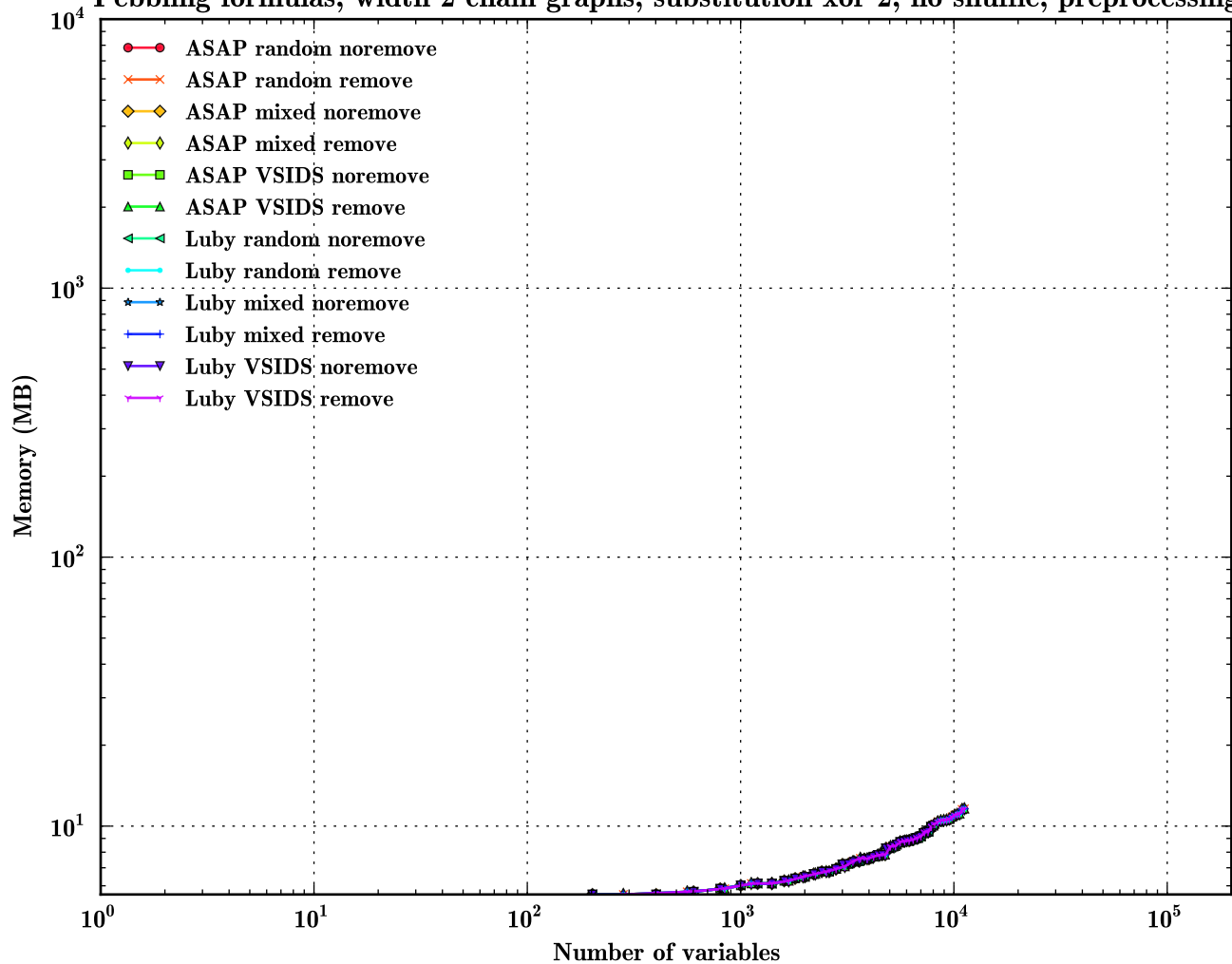
Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, no preprocessing



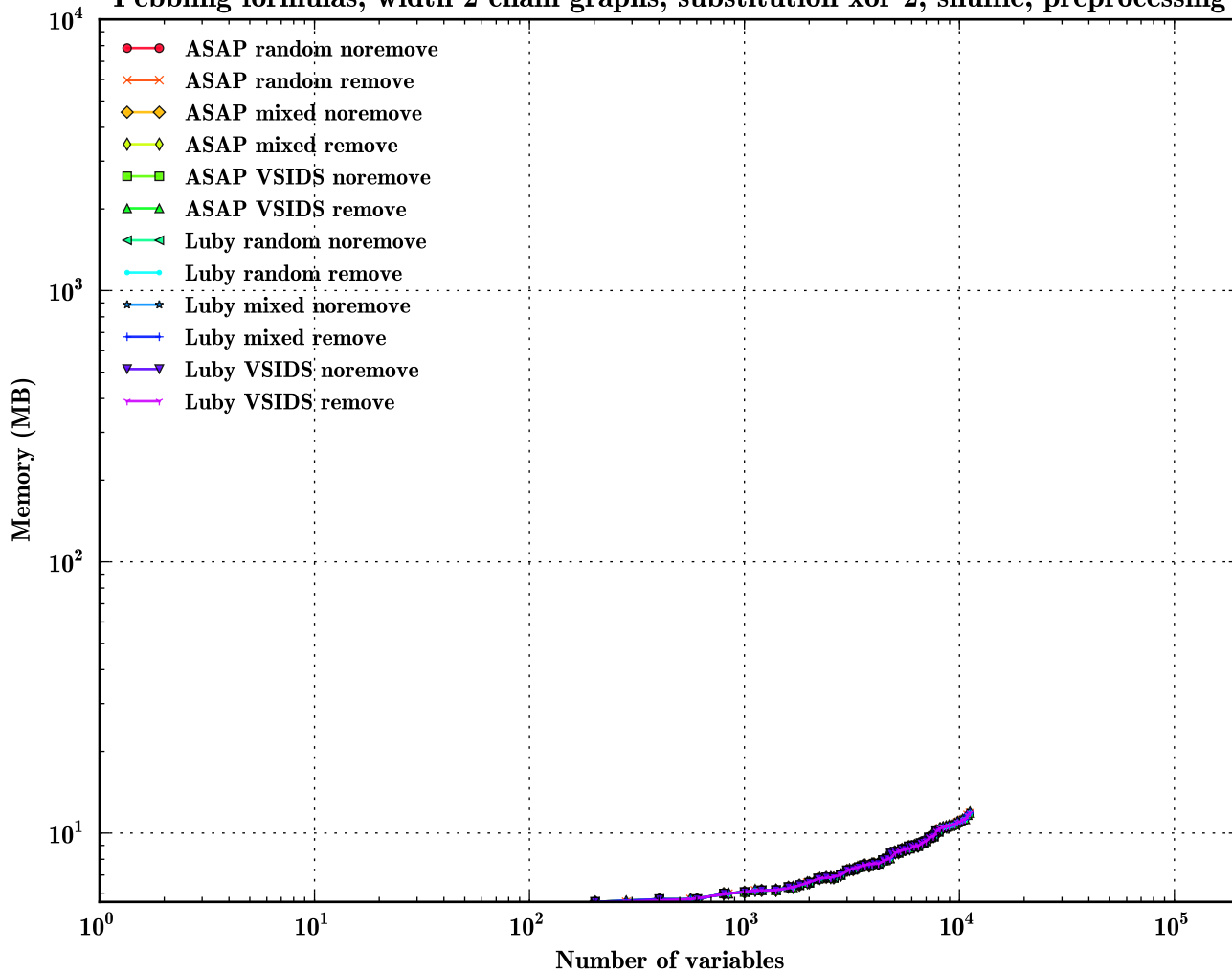
# Pebbling formulas, width 2 chain graphs, substitution xor 2, shuffle, no preprocessing



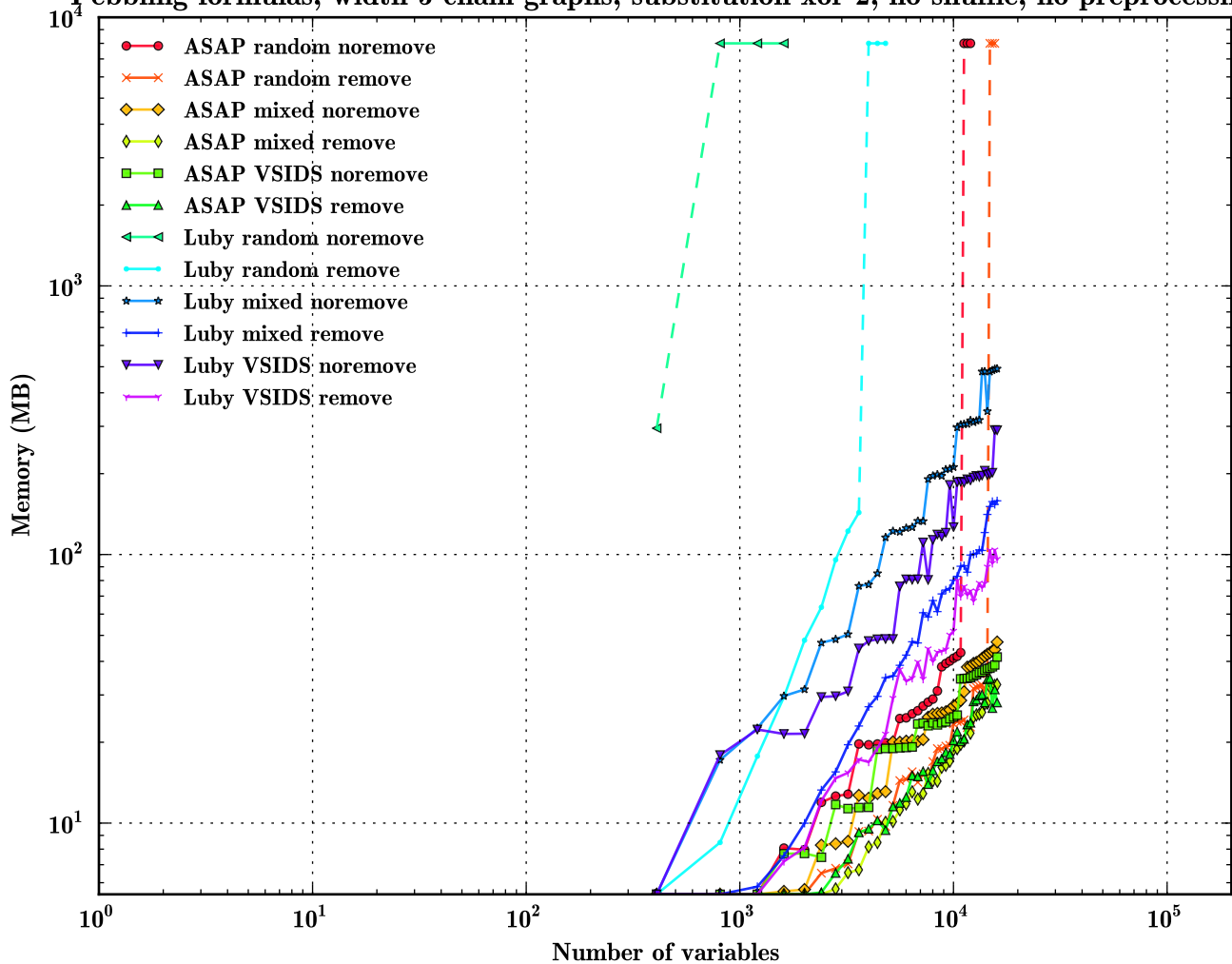
# Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, preprocessing



# Pebbling formulas, width 2 chain graphs, substitution xor 2, shuffle, preprocessing

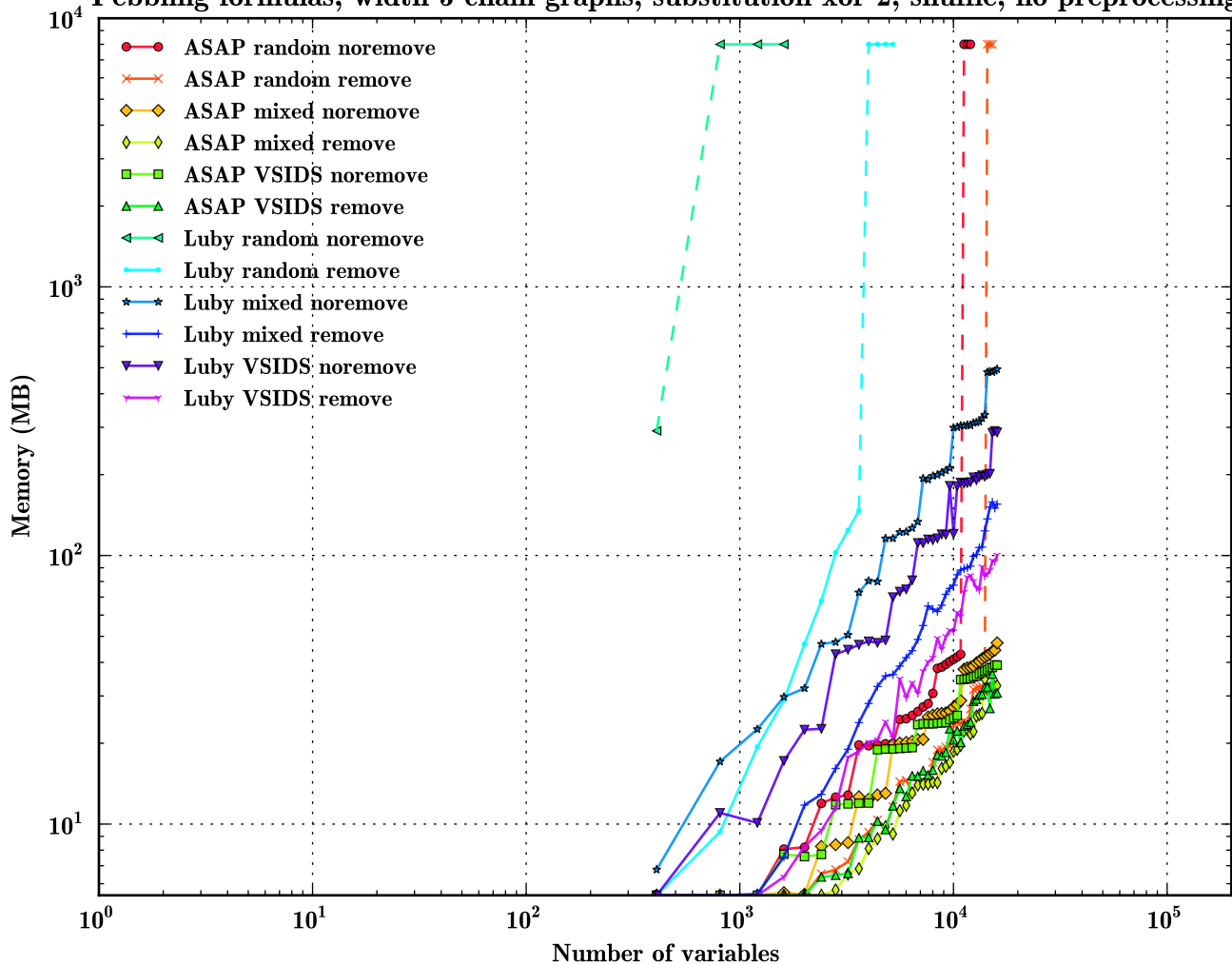


Pebbling formulas, width 5 chain graphs, substitution xor 2, no shuffle, no preprocessing

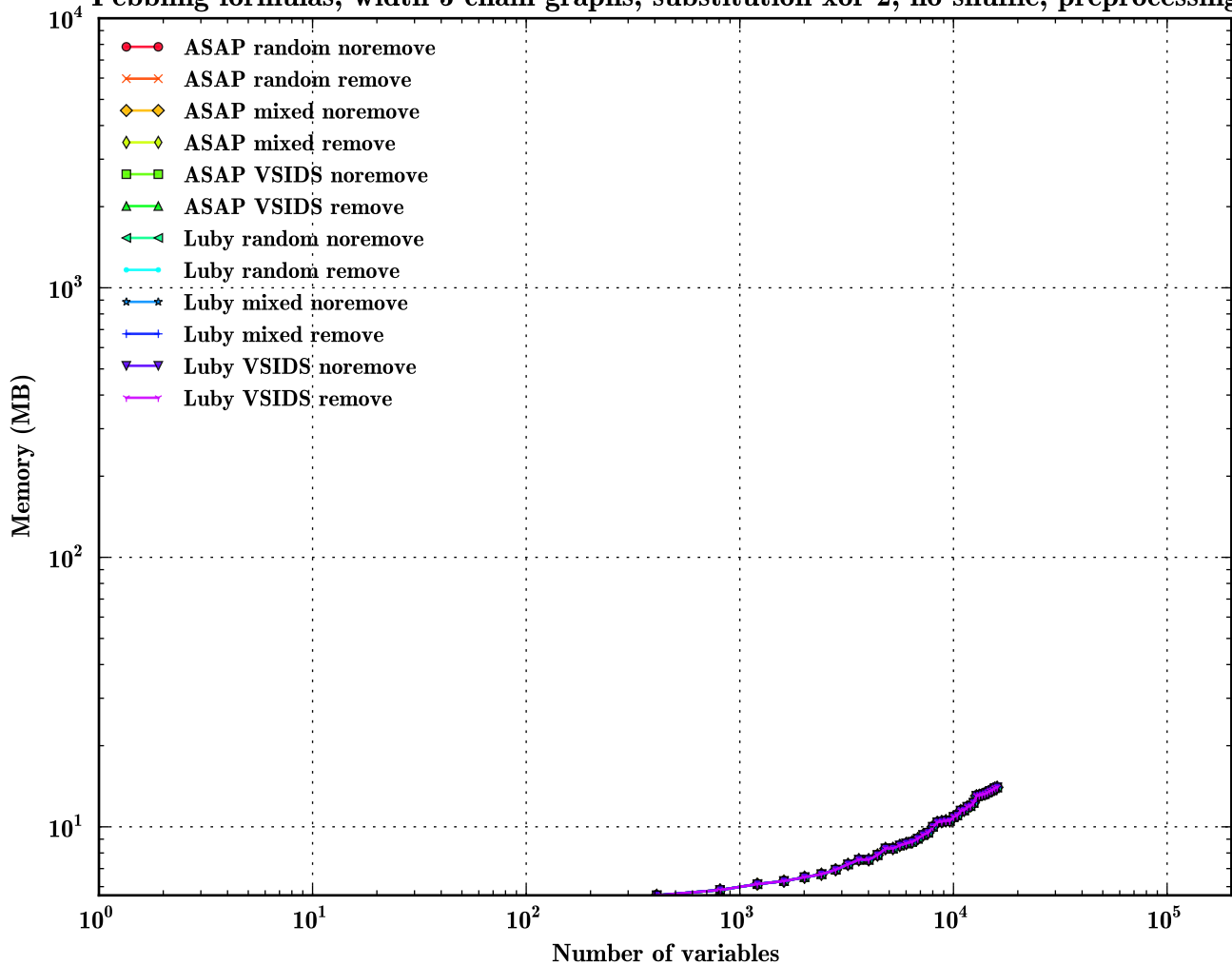




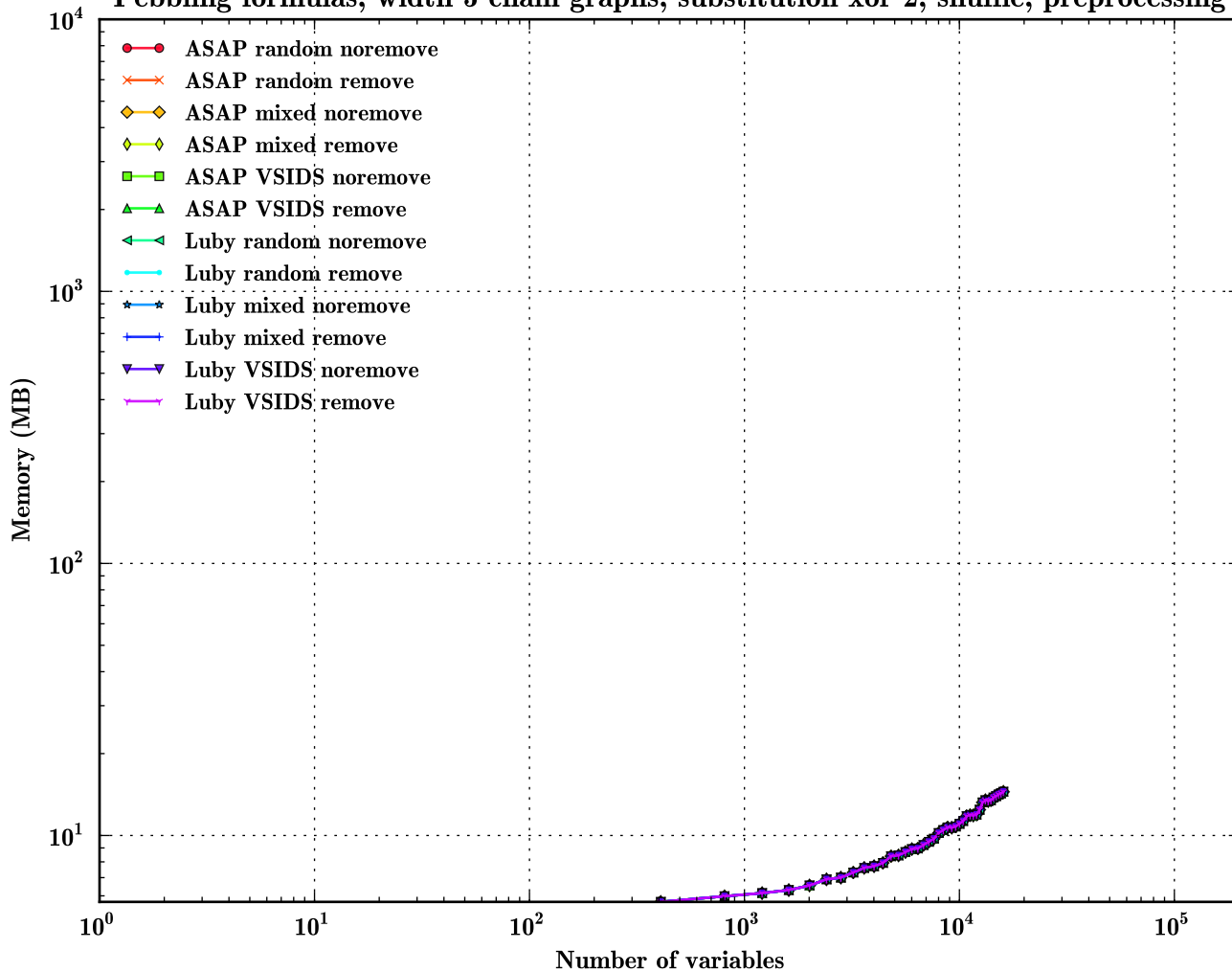
Pebbling formulas, width 5 chain graphs, substitution xor 2, shuffle, no preprocessing



# Pebbling formulas, width 5 chain graphs, substitution xor 2, no shuffle, preprocessing

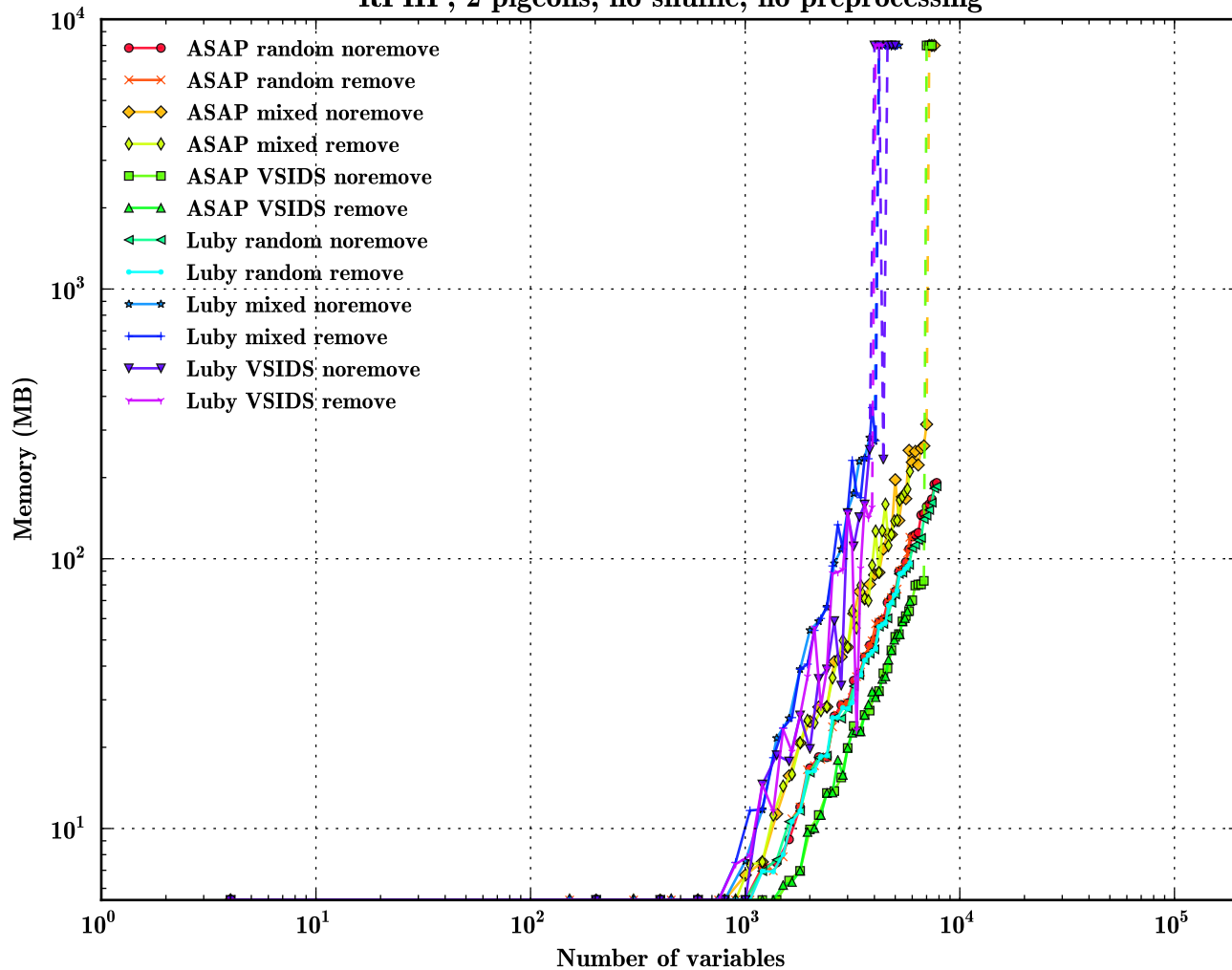


# Pebbling formulas, width 5 chain graphs, substitution xor 2, shuffle, preprocessing



# **Relativized pigeonhole principle formulas (RPHP)**

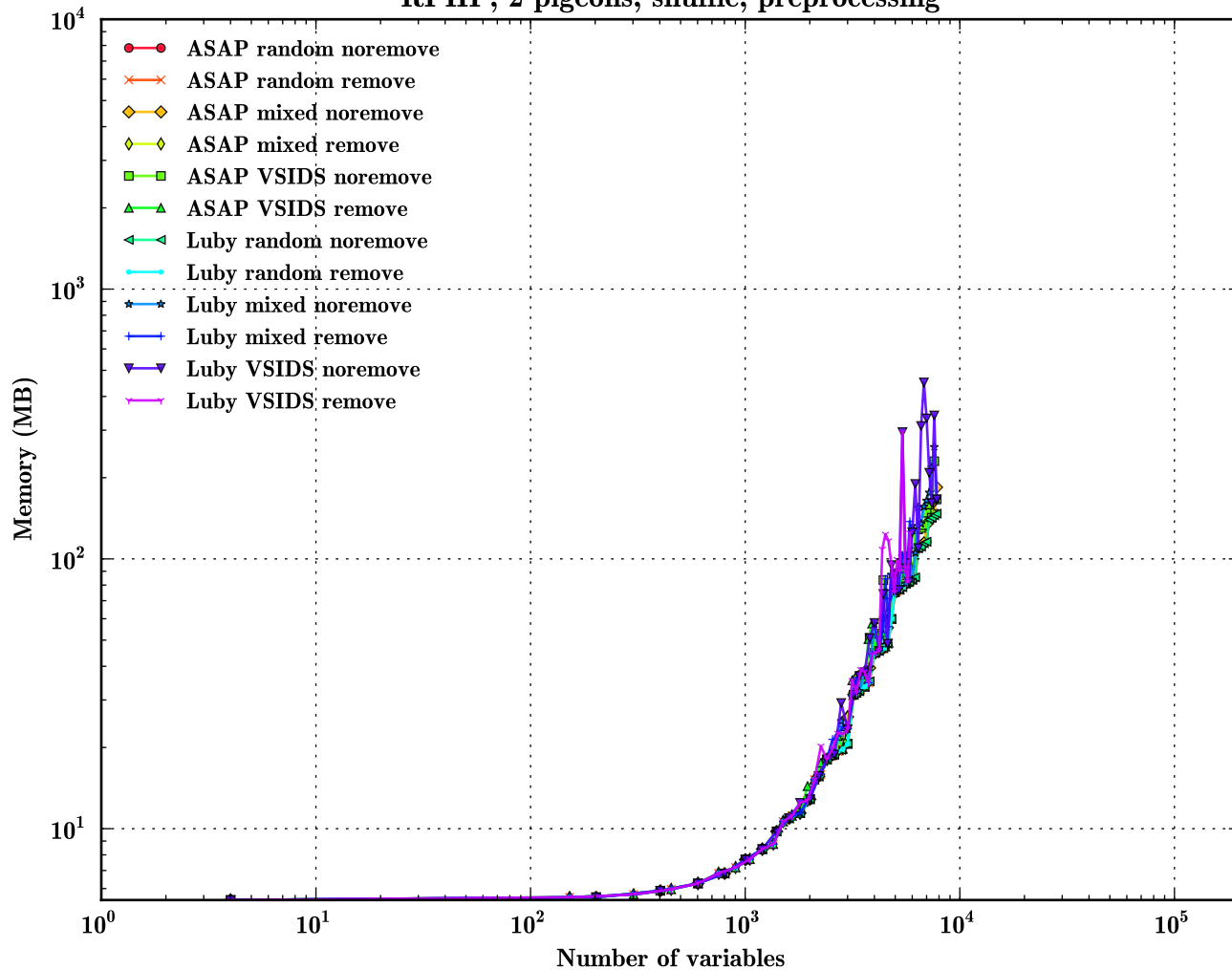
# RPHP, 2 pigeons, no shuffle, no preprocessing





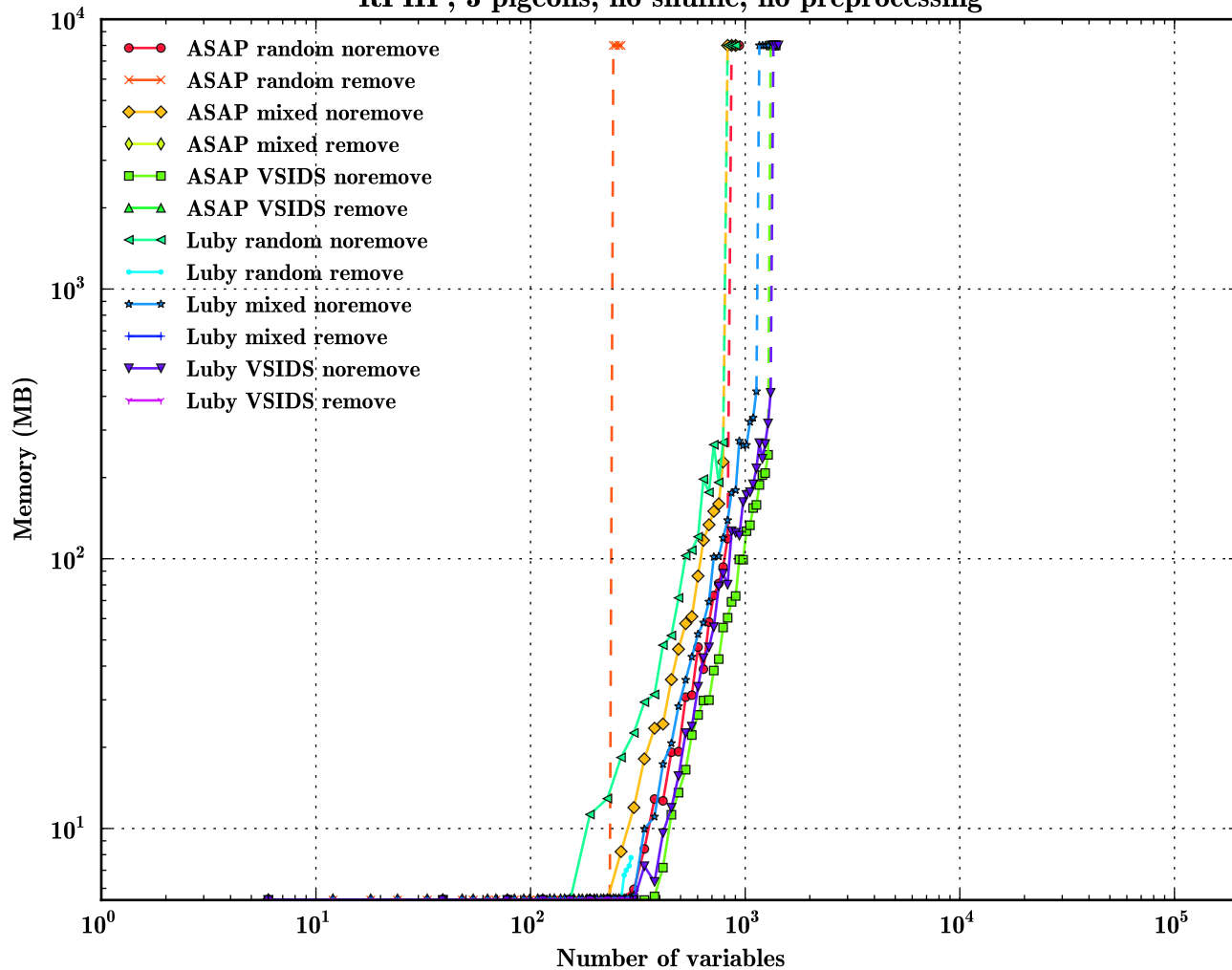


# RPHP, 2 pigeons, shuffle, preprocessing

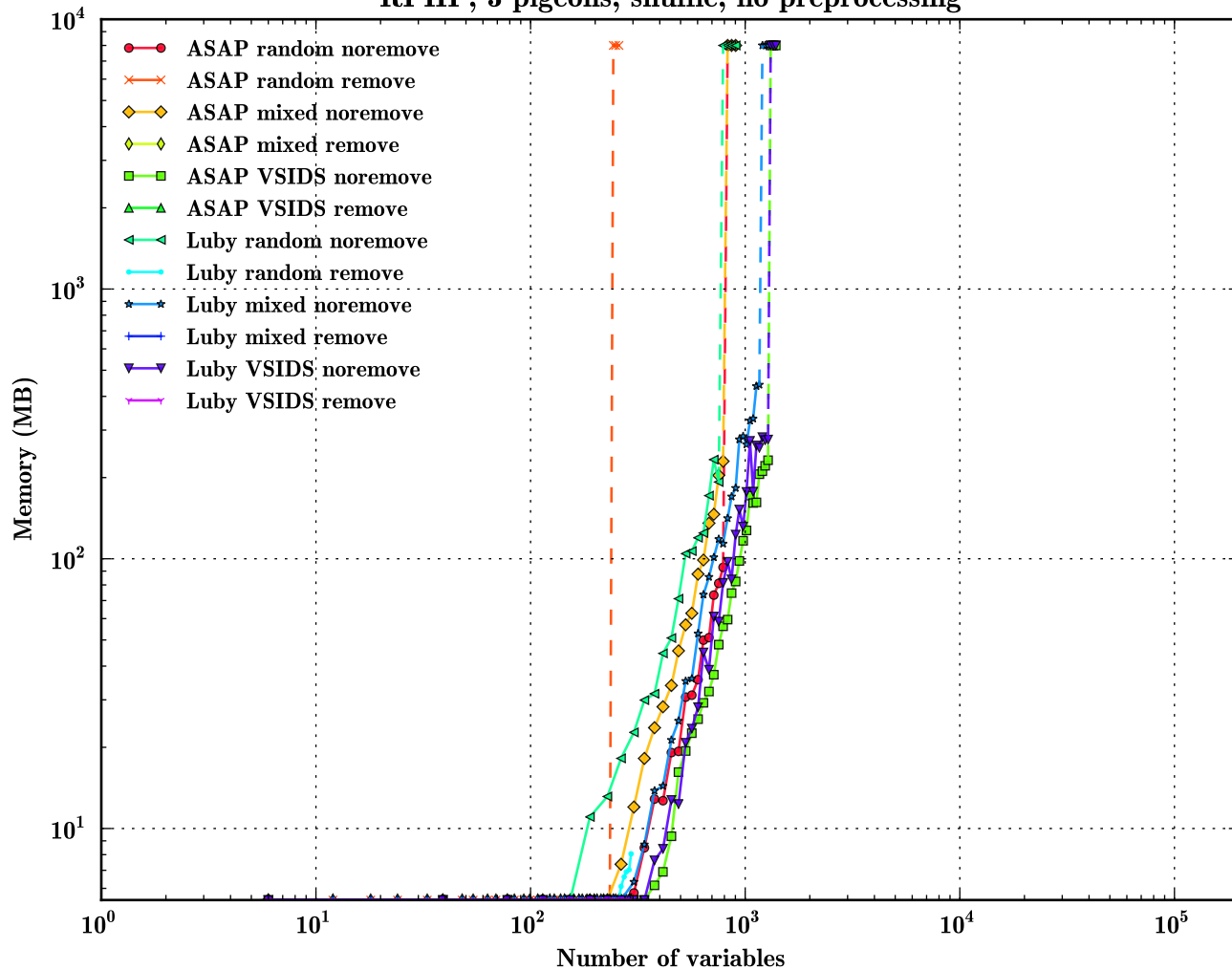




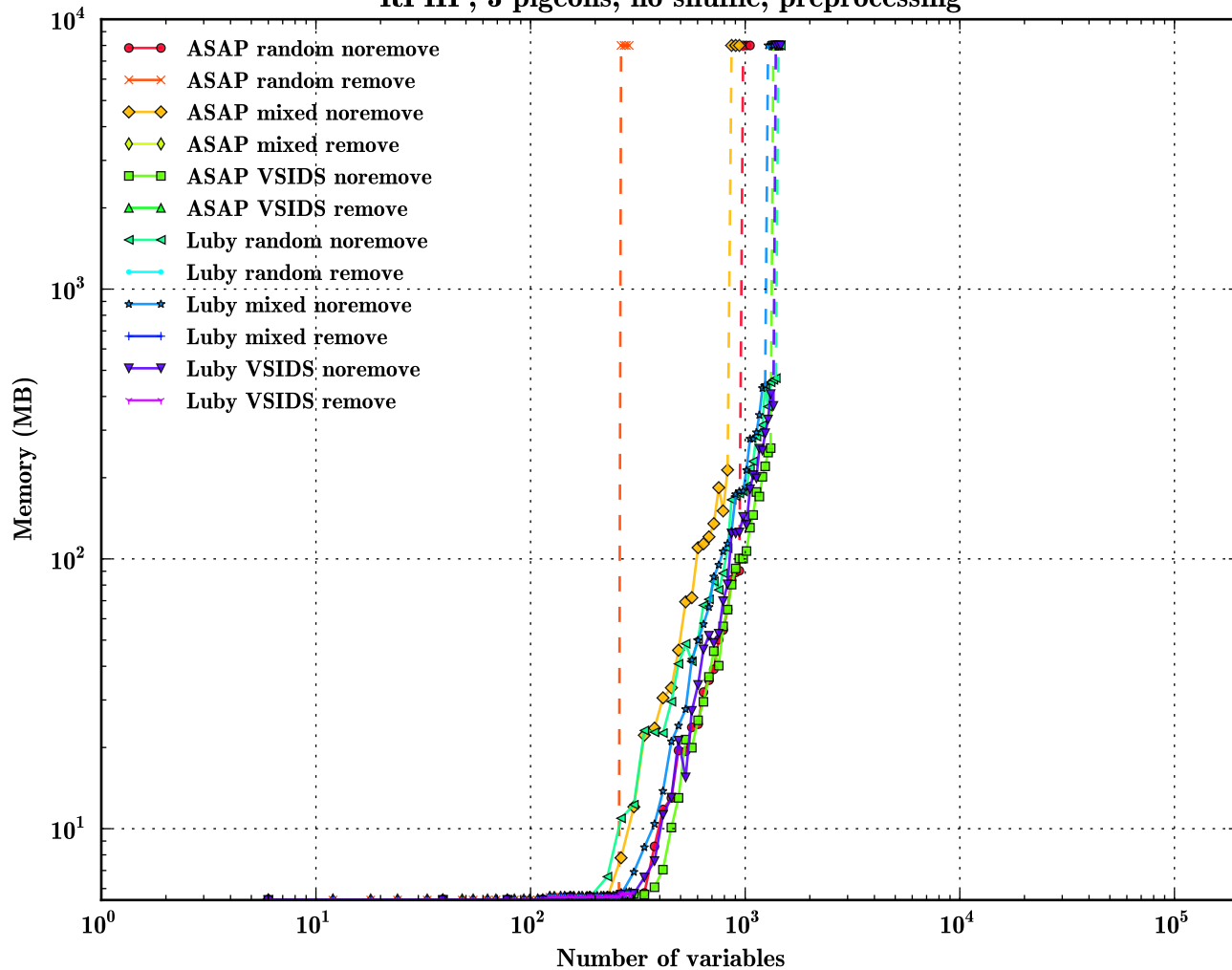
# RPHP, 3 pigeons, no shuffle, no preprocessing



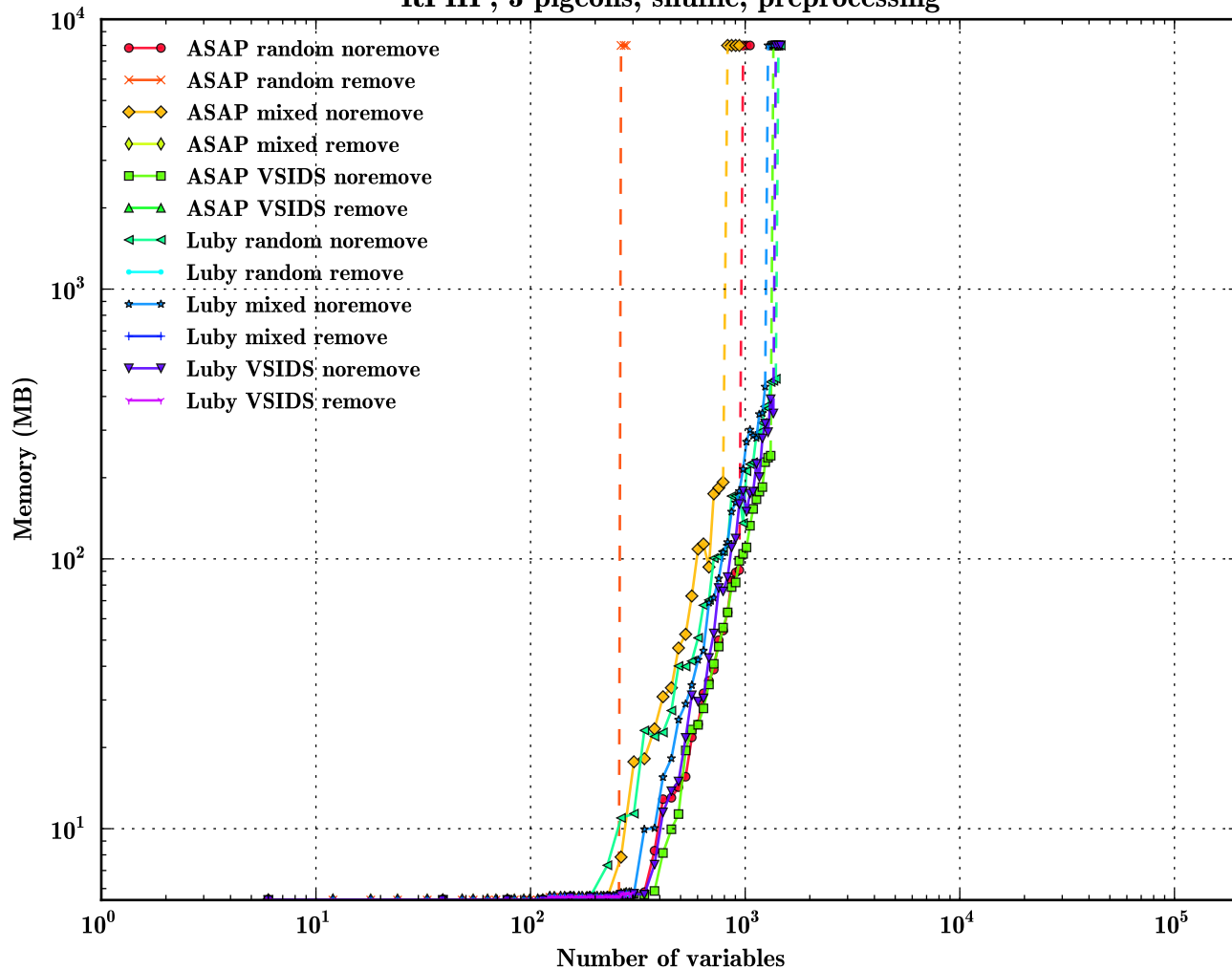
# RPHP, 3 pigeons, shuffle, no preprocessing



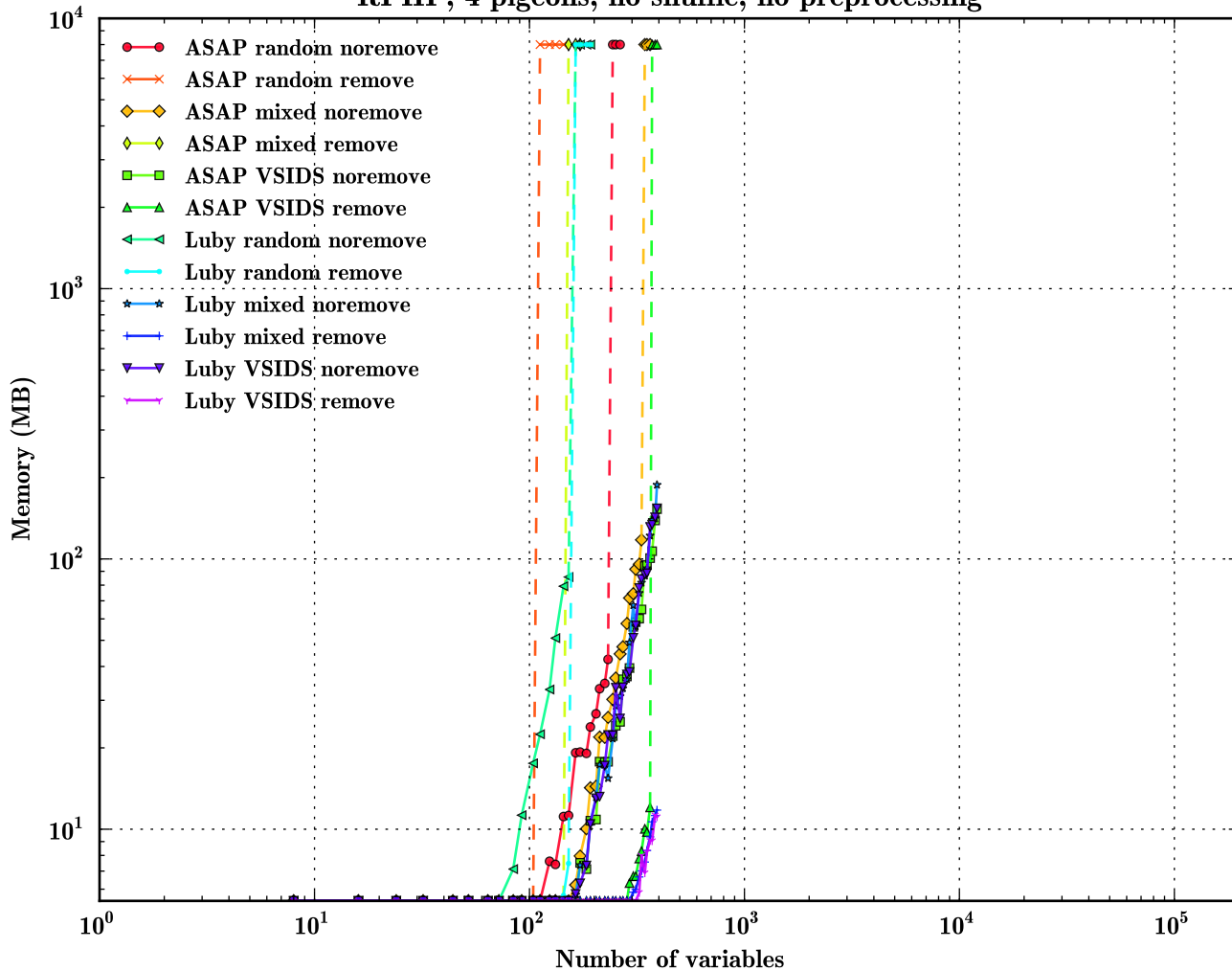
# RPHP, 3 pigeons, no shuffle, preprocessing



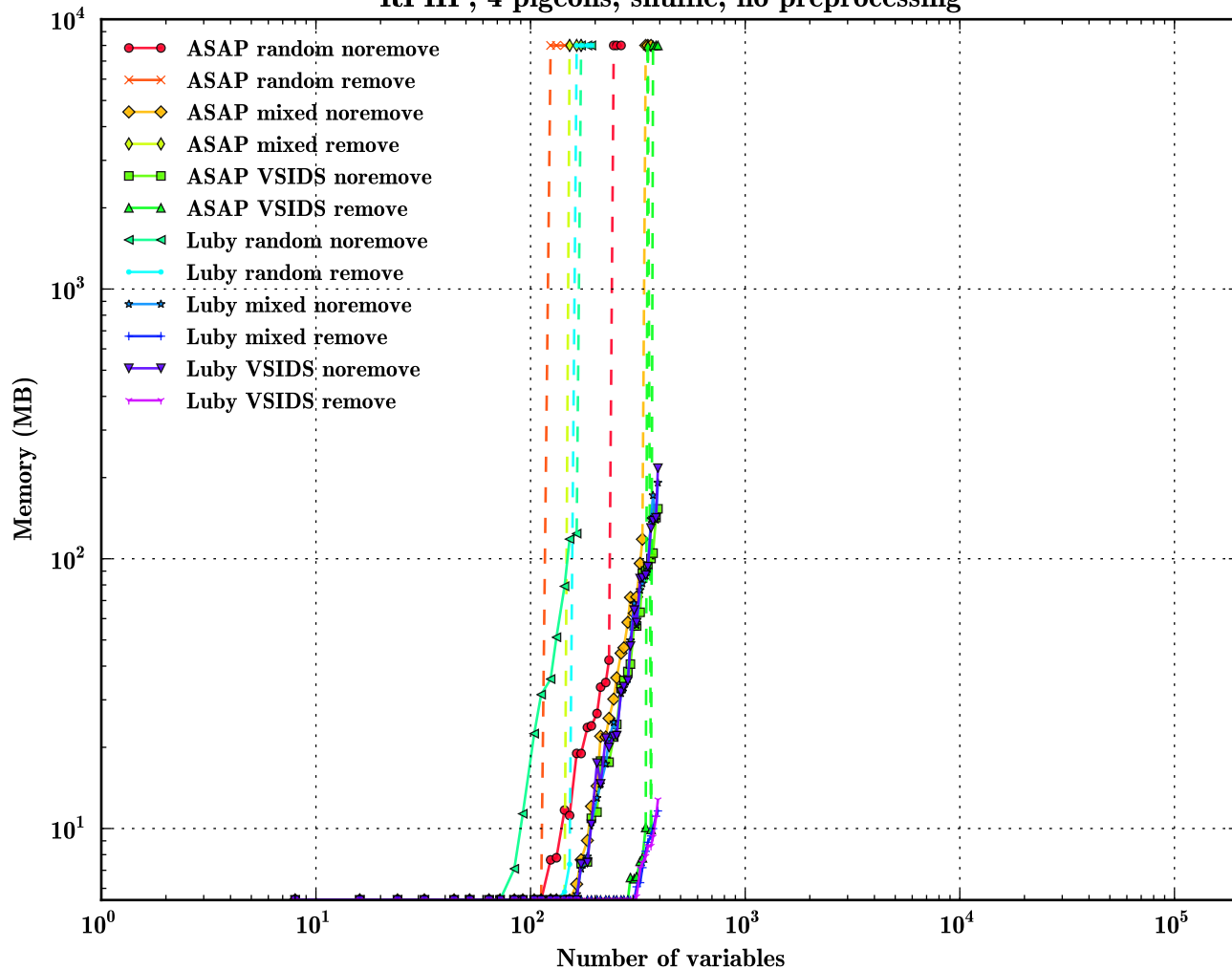
# RPHP, 3 pigeons, shuffle, preprocessing



# RPHP, 4 pigeons, no shuffle, no preprocessing

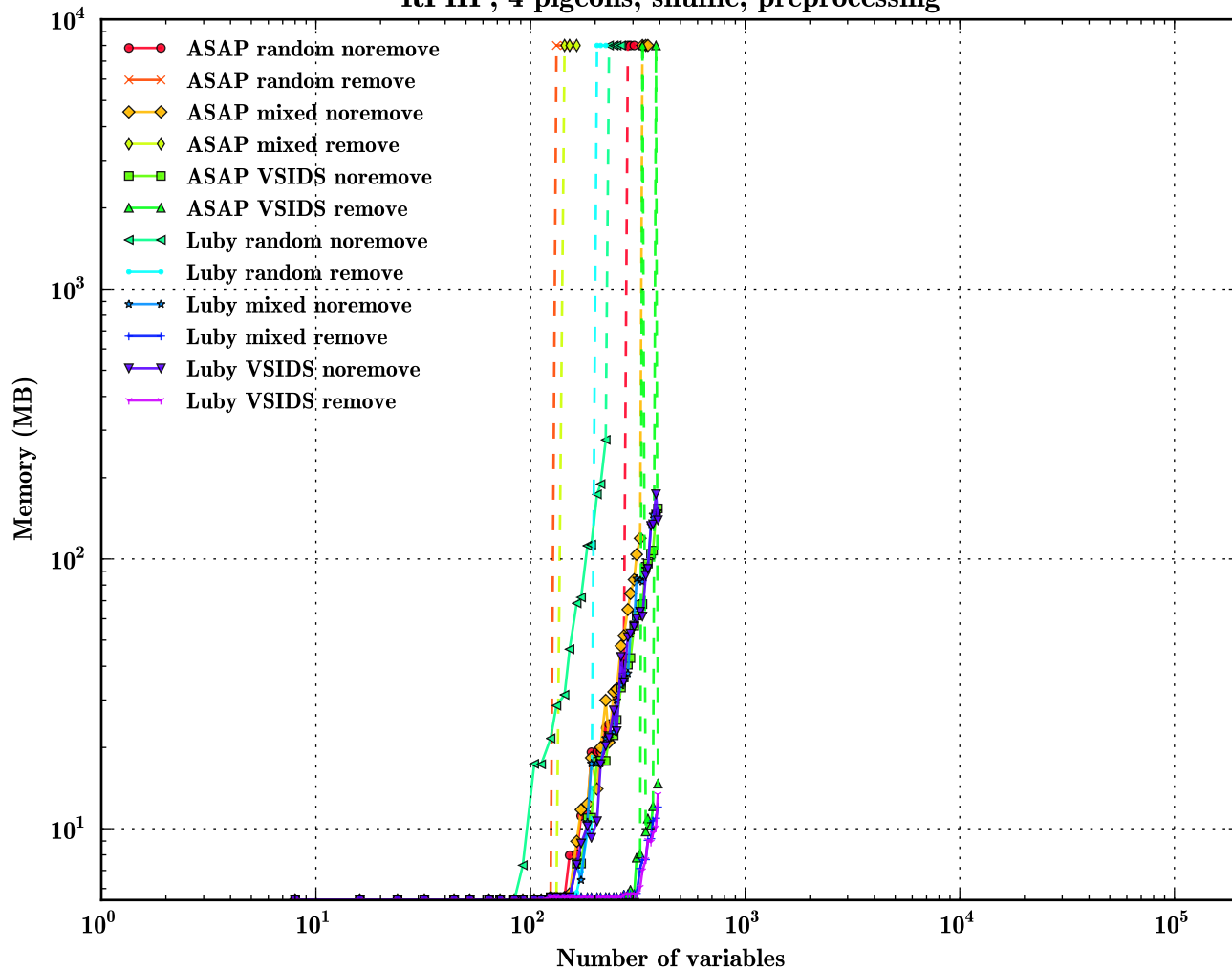


# RPHP, 4 pigeons, shuffle, no preprocessing



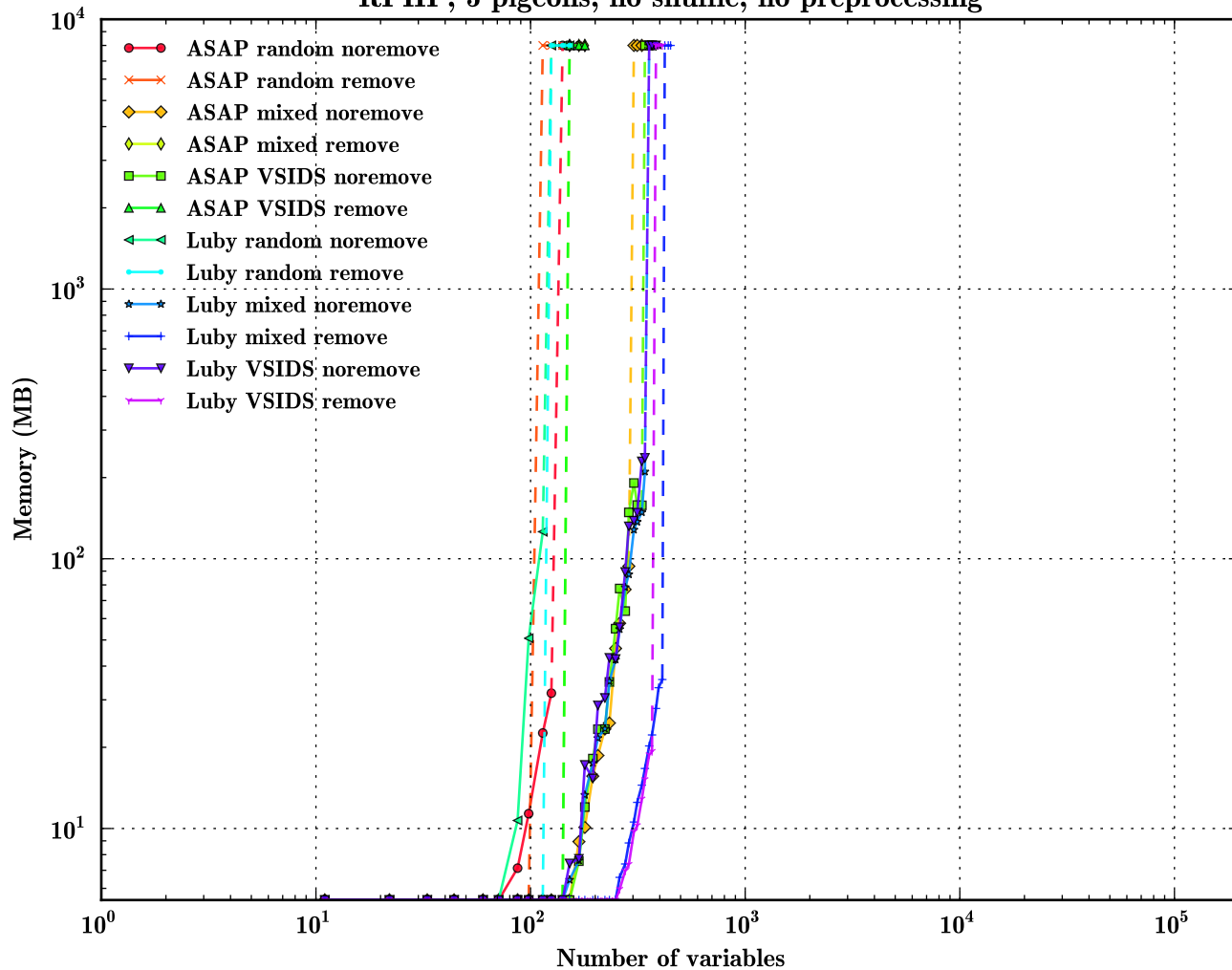


# RPHP, 4 pigeons, shuffle, preprocessing

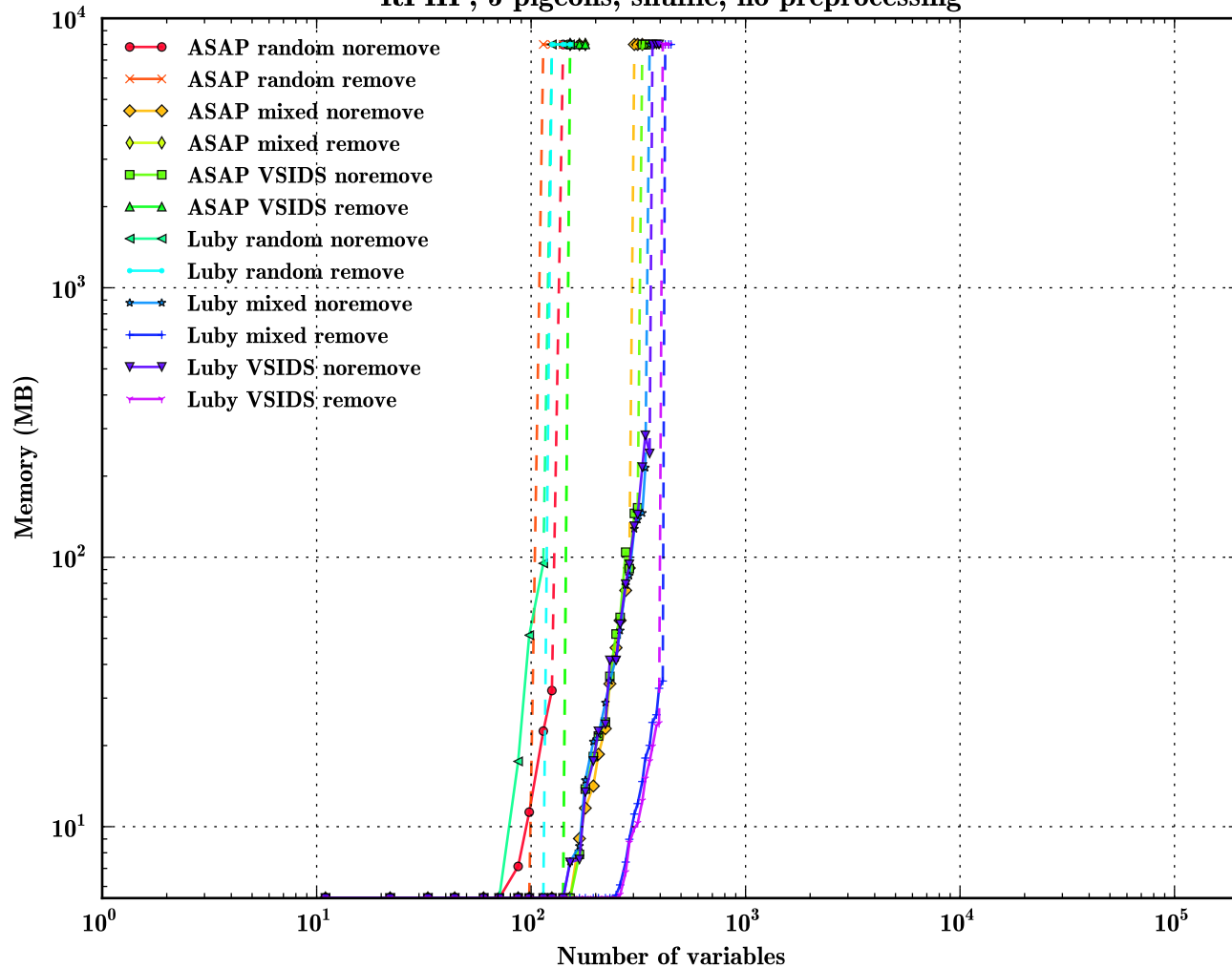




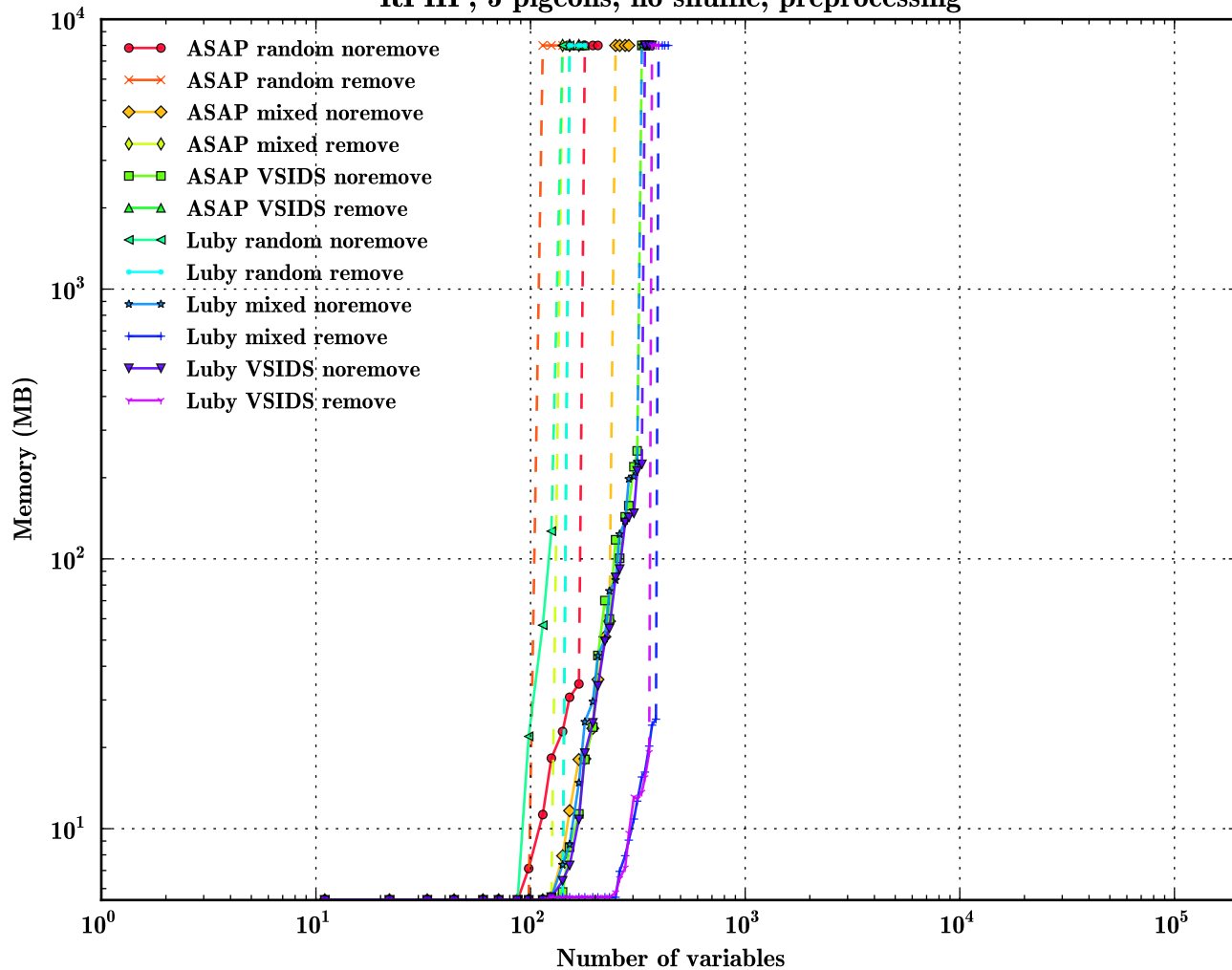
# RPHP, 5 pigeons, no shuffle, no preprocessing



# RPHP, 5 pigeons, shuffle, no preprocessing



# RPHP, 5 pigeons, no shuffle, preprocessing

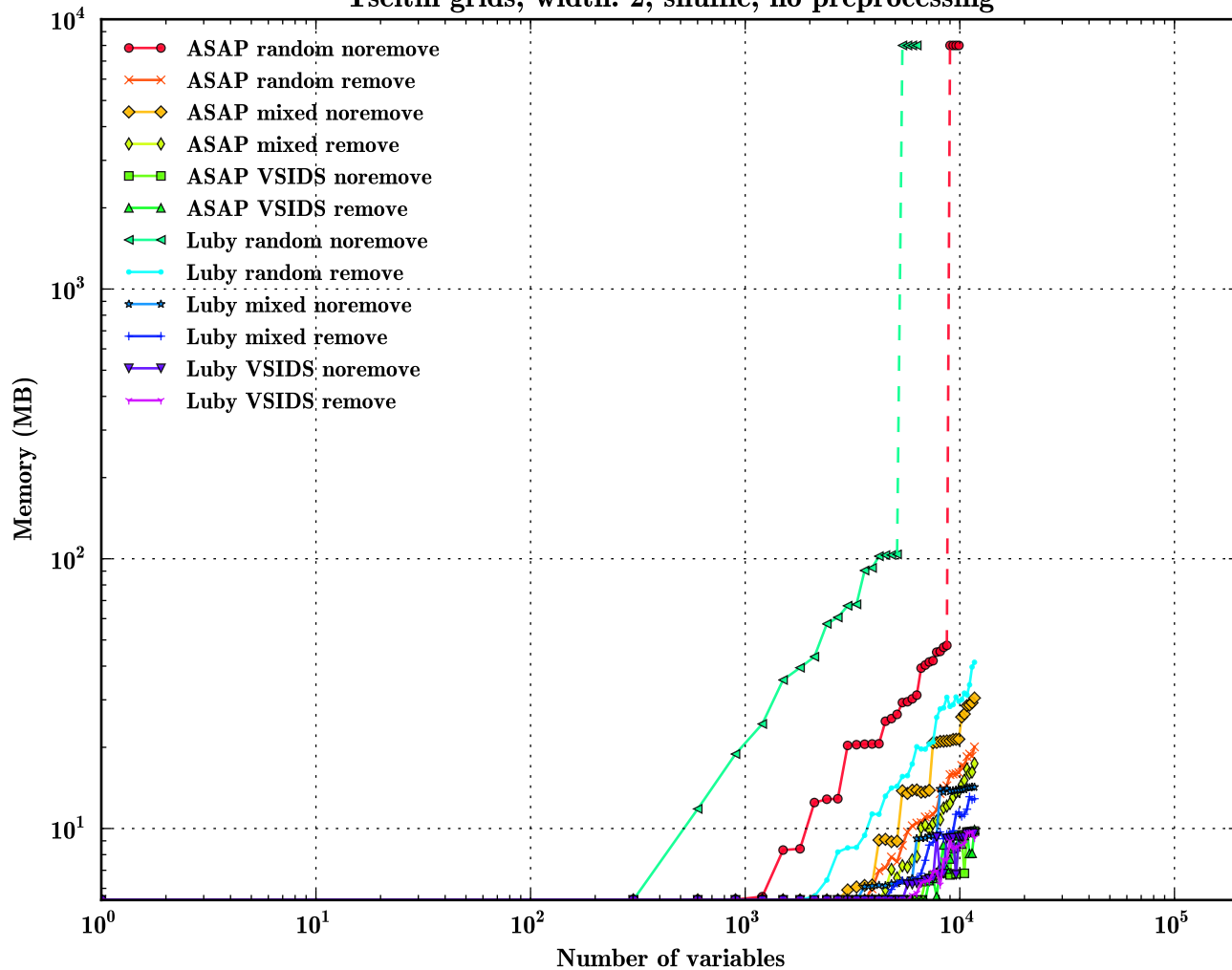




# Tseitin grids



Tseitin grids, width: 2, shuffle, no preprocessing

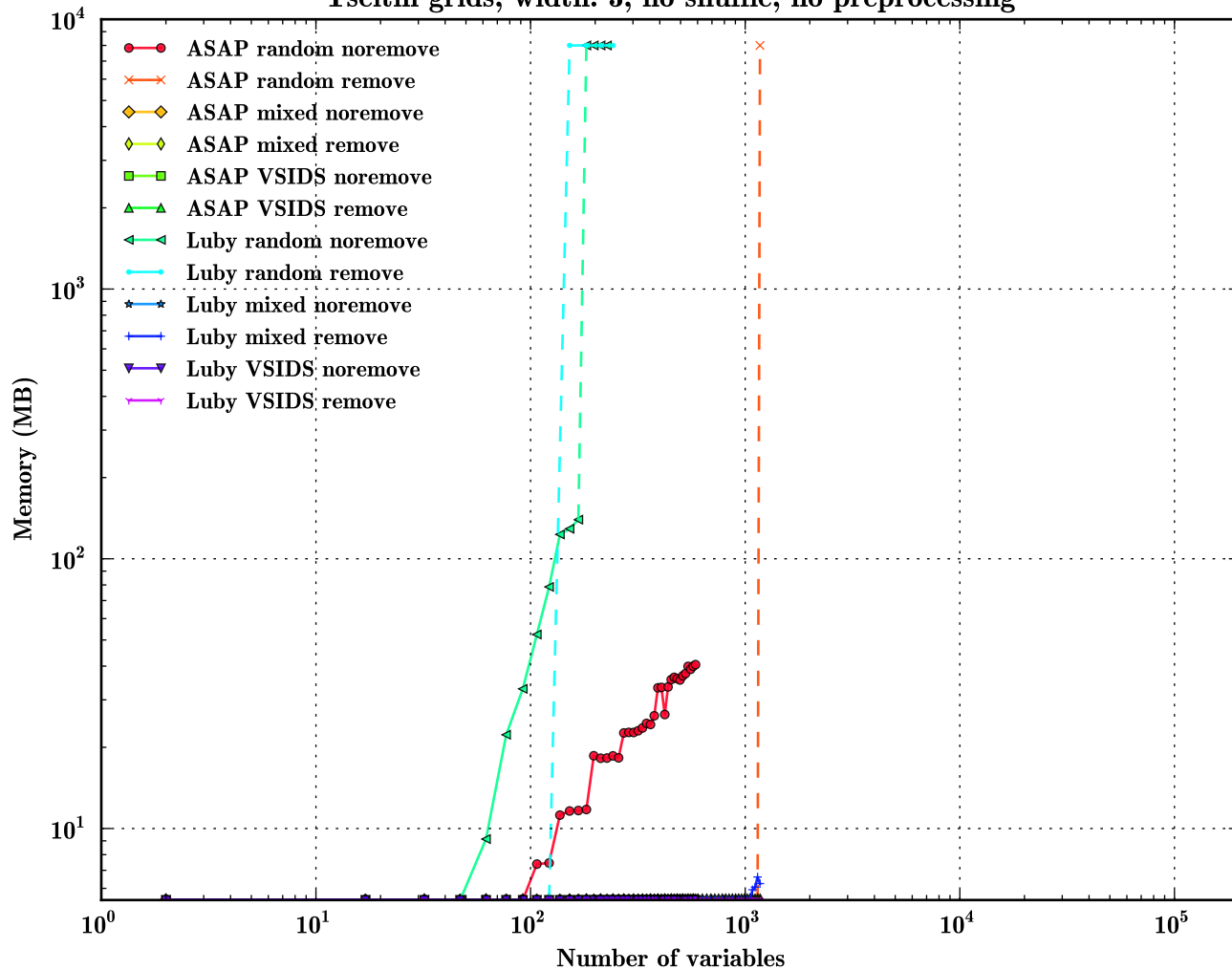




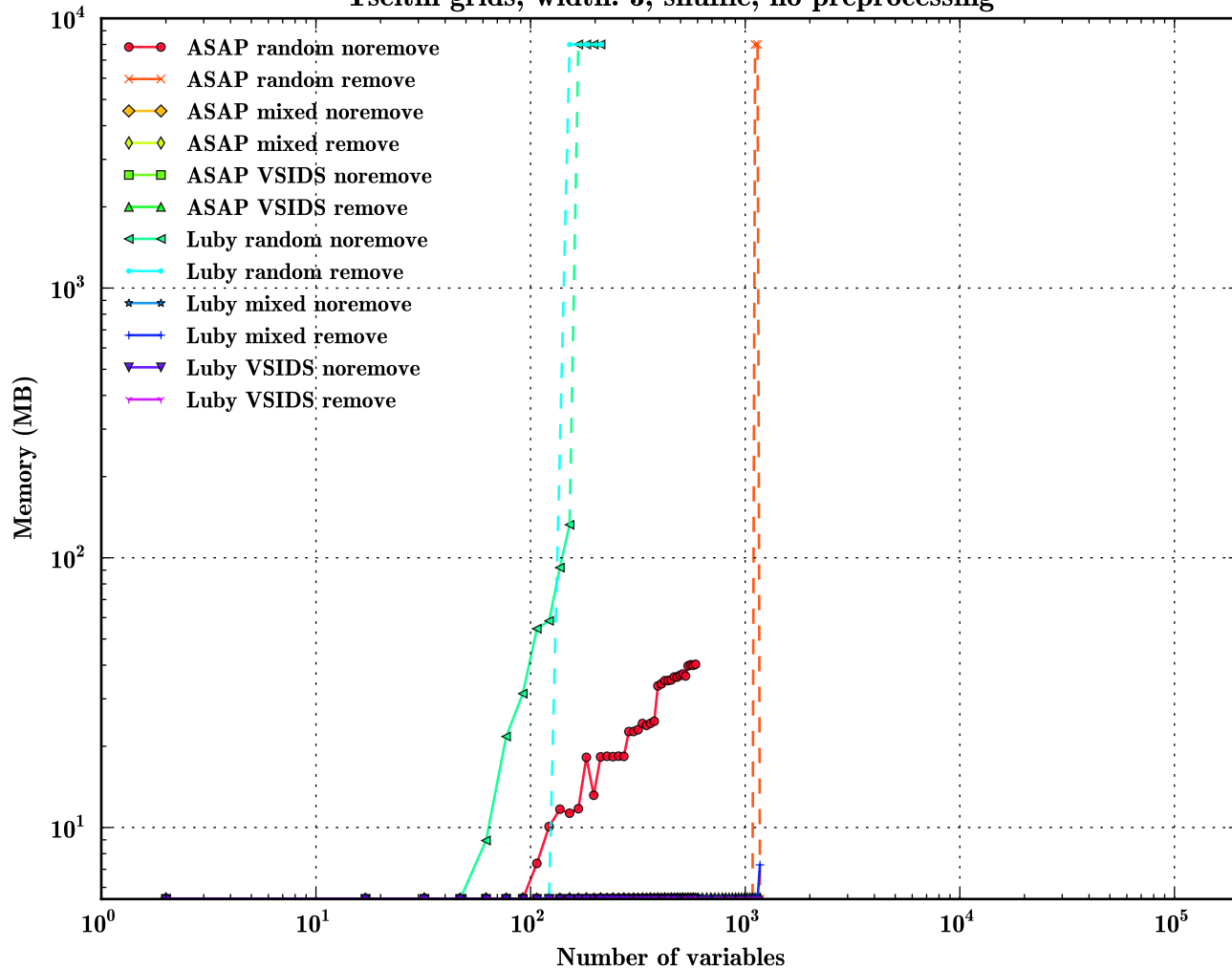




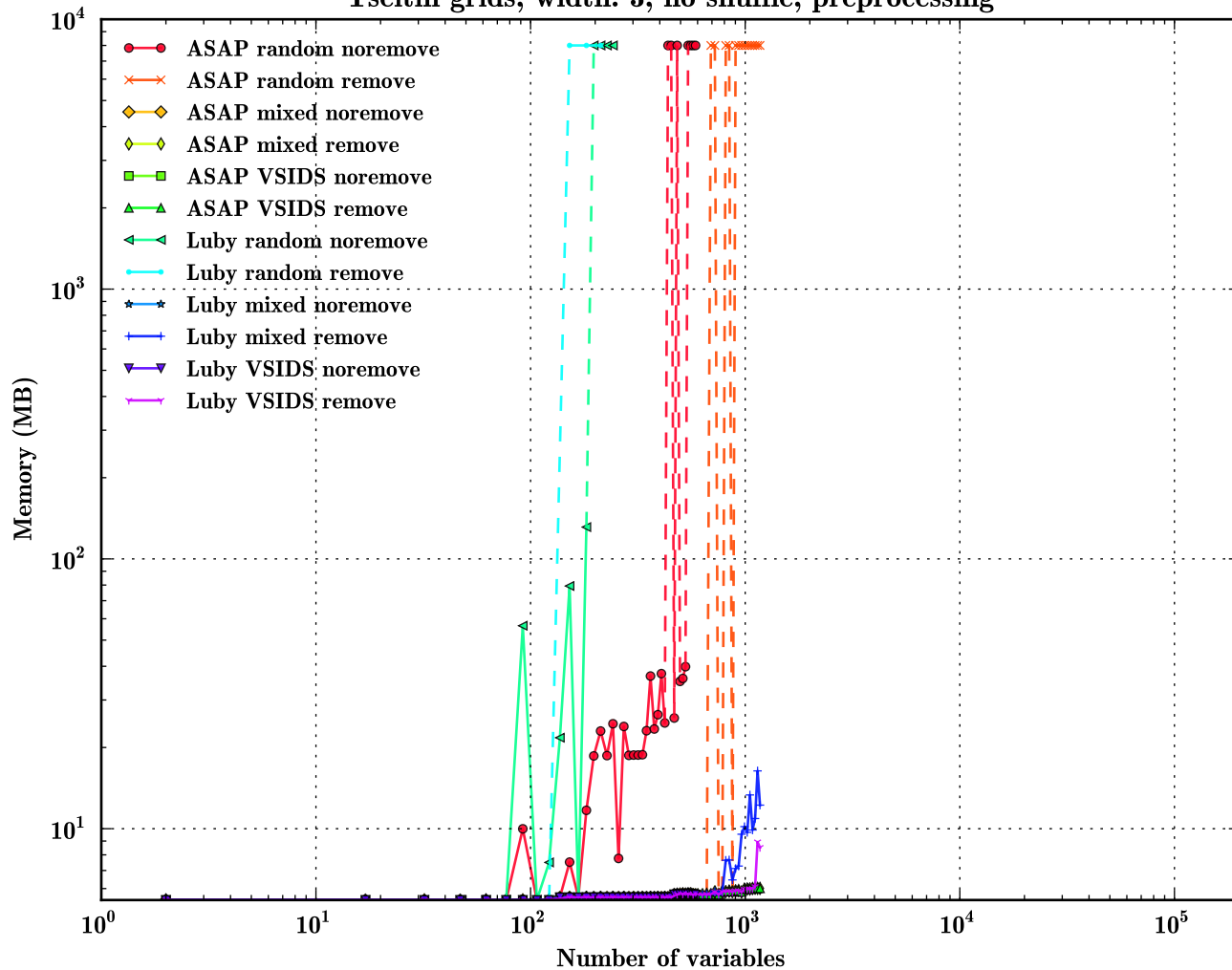
Tseitin grids, width: 3, no shuffle, no preprocessing



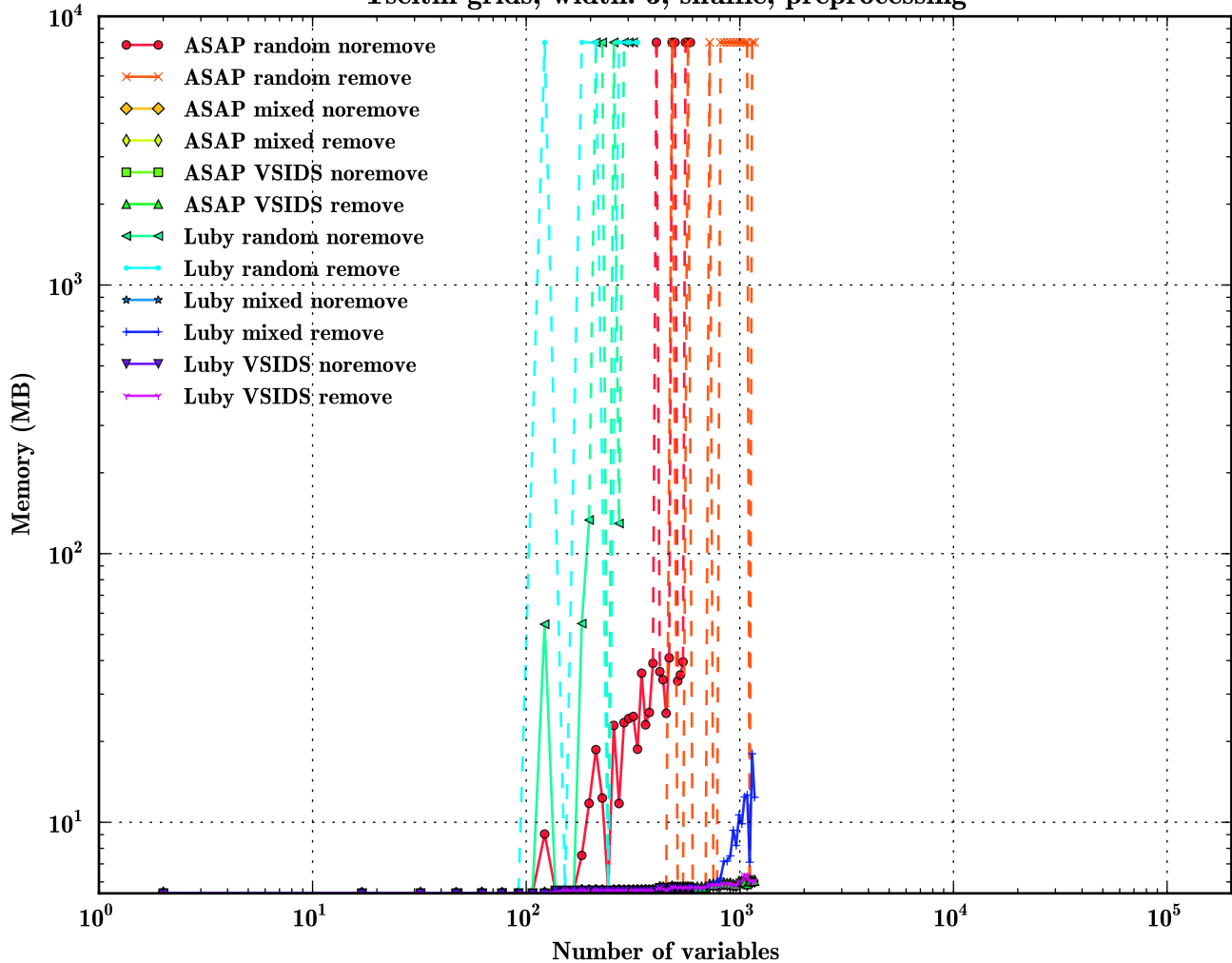
Tseitlin grids, width: 3, shuffle, no preprocessing



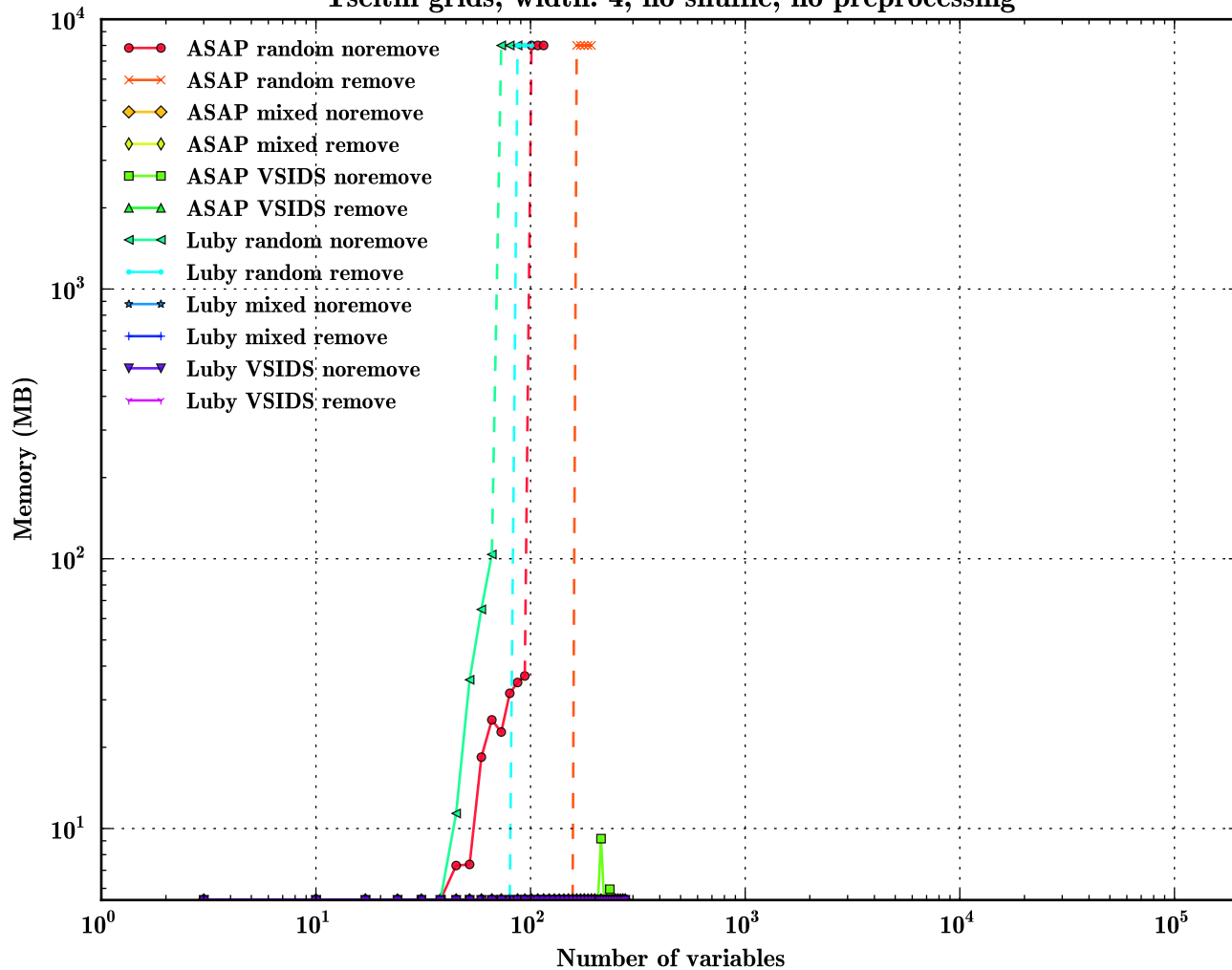
Tseitin grids, width: 3, no shuffle, preprocessing



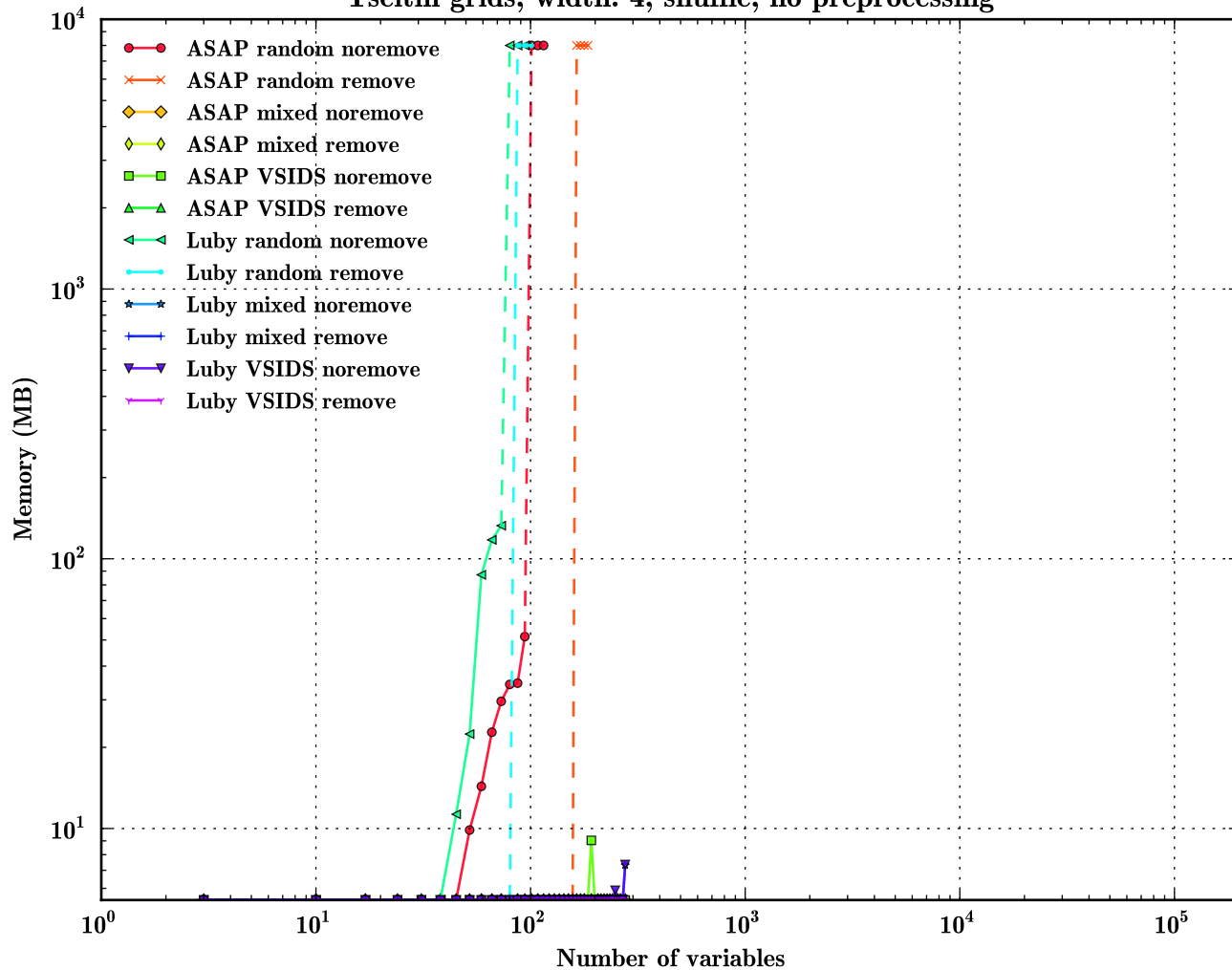
### Tseitin grids, width: 3, shuffle, preprocessing



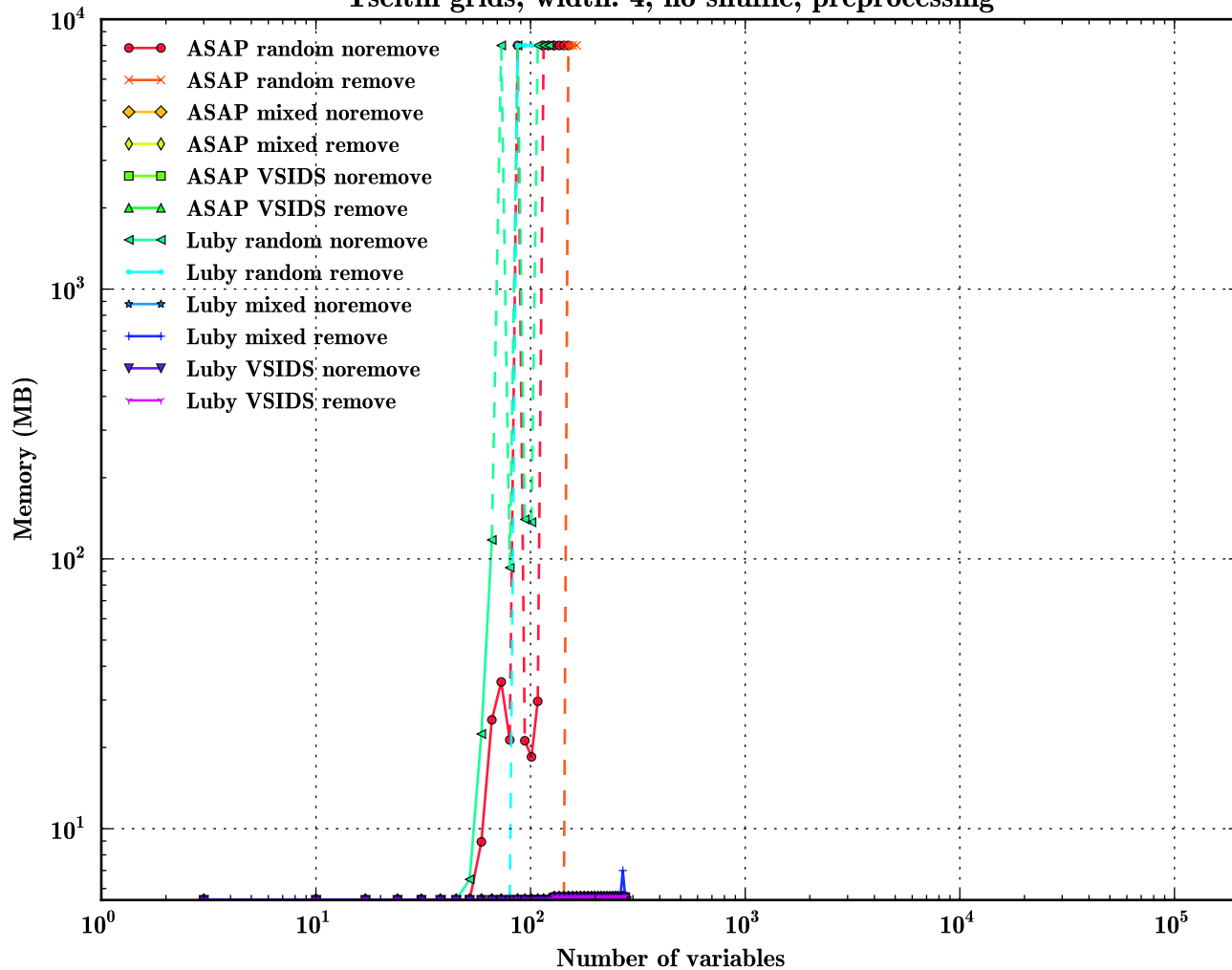
Tseitin grids, width: 4, no shuffle, no preprocessing



Tseitlin grids, width: 4, shuffle, no preprocessing

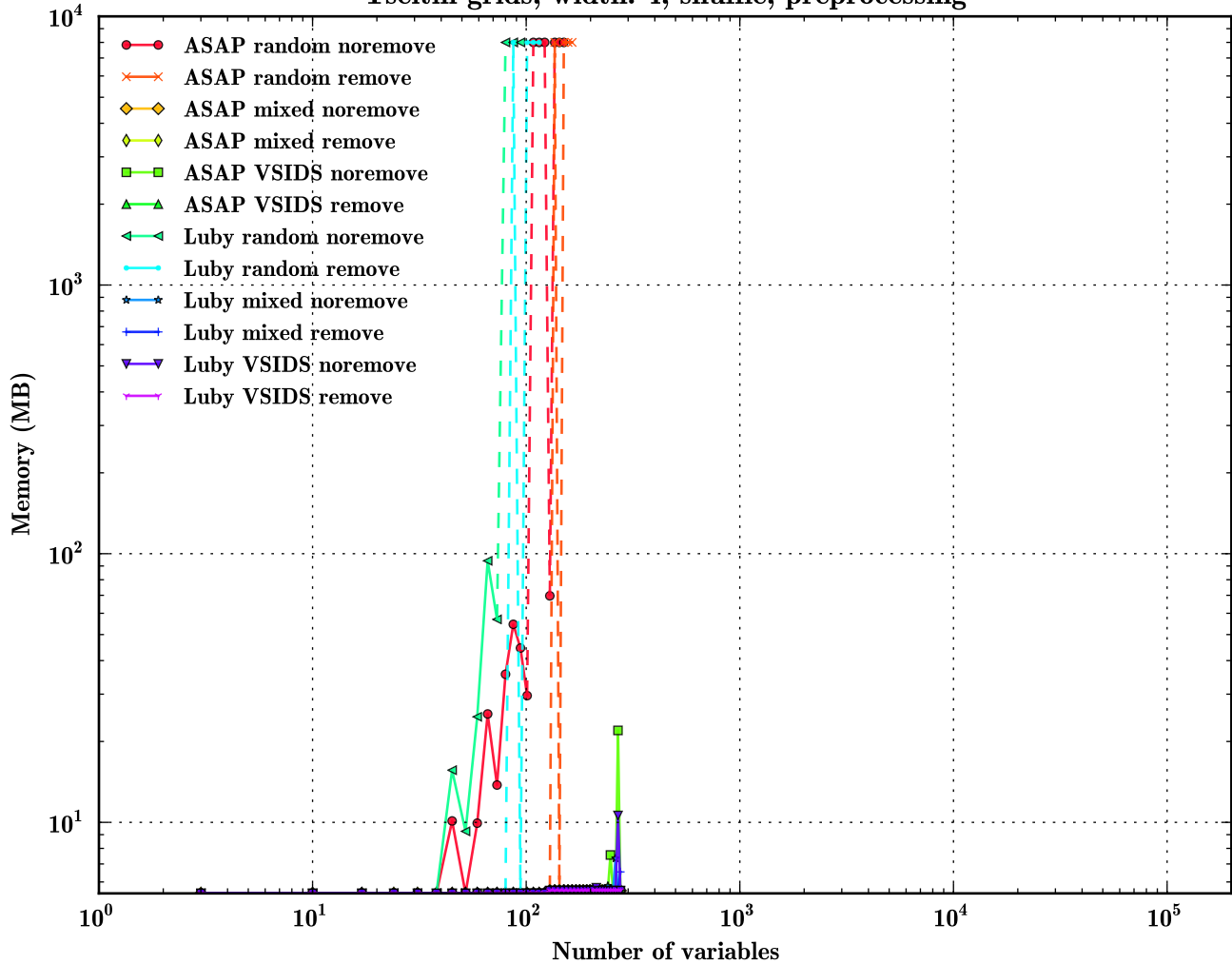


Tseitin grids, width: 4, no shuffle, preprocessing

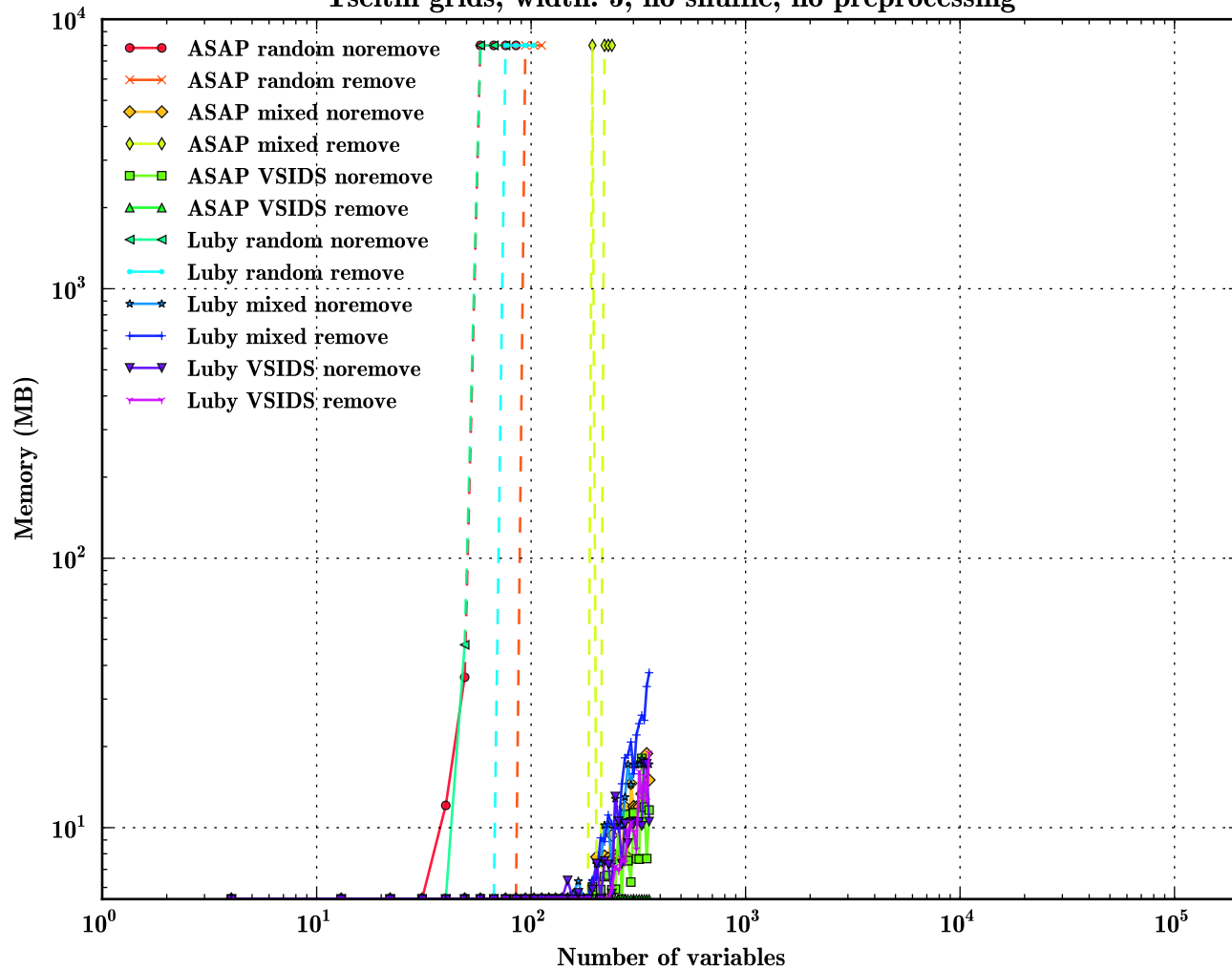




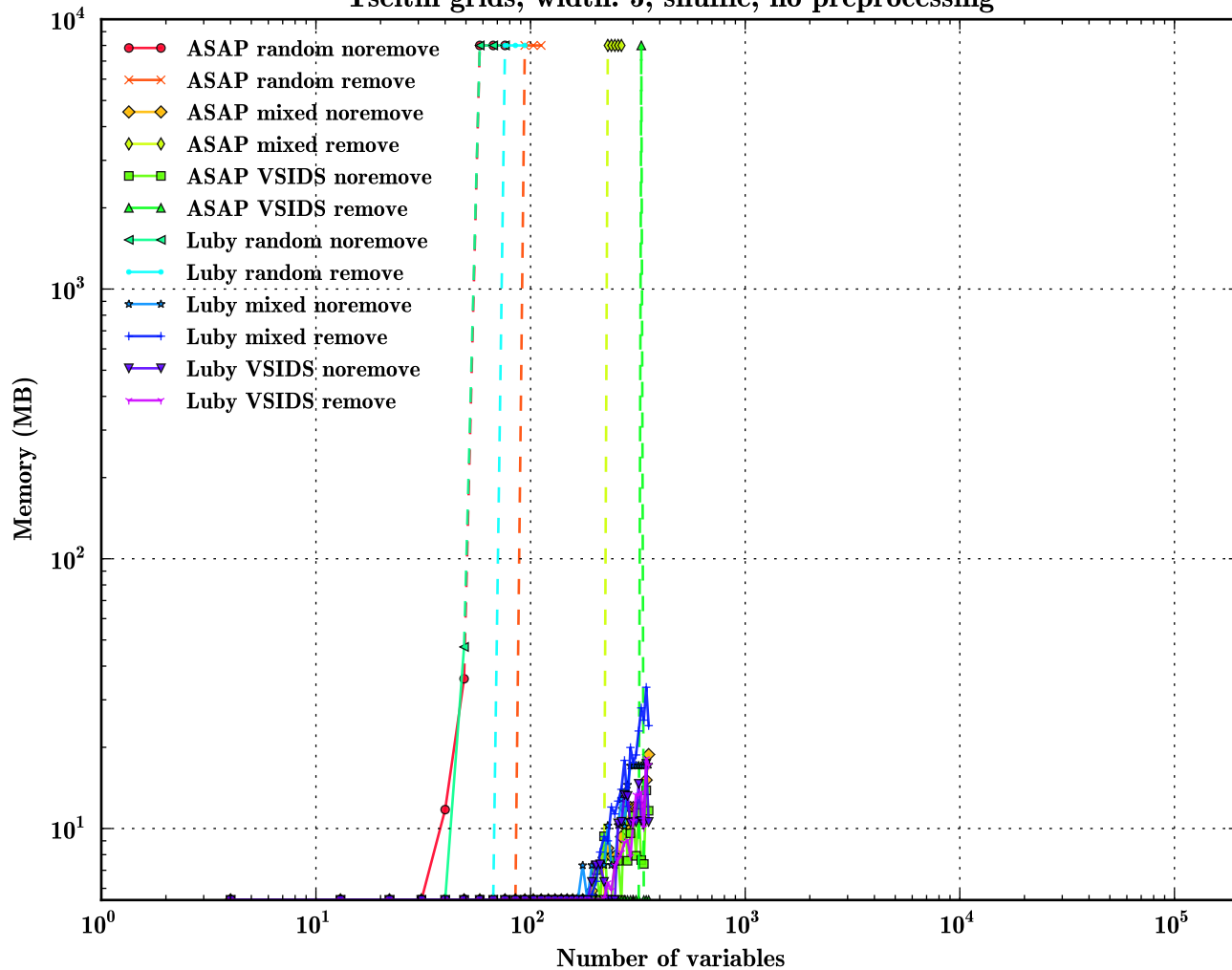
Tseitin grids, width: 4, shuffle, preprocessing



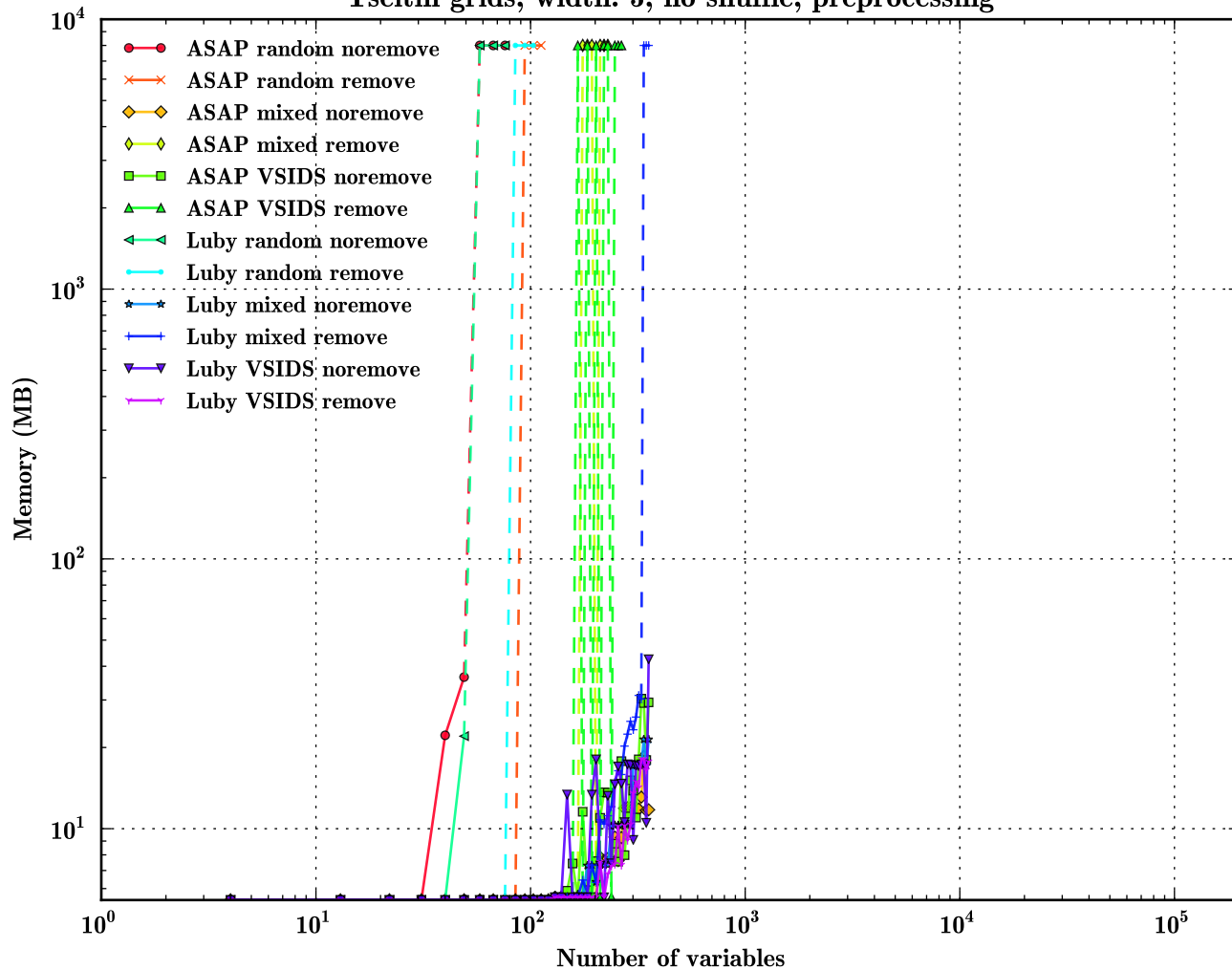
Tseitin grids, width: 5, no shuffle, no preprocessing



Tseitin grids, width: 5, shuffle, no preprocessing



Tseitin grids, width: 5, no shuffle, preprocessing

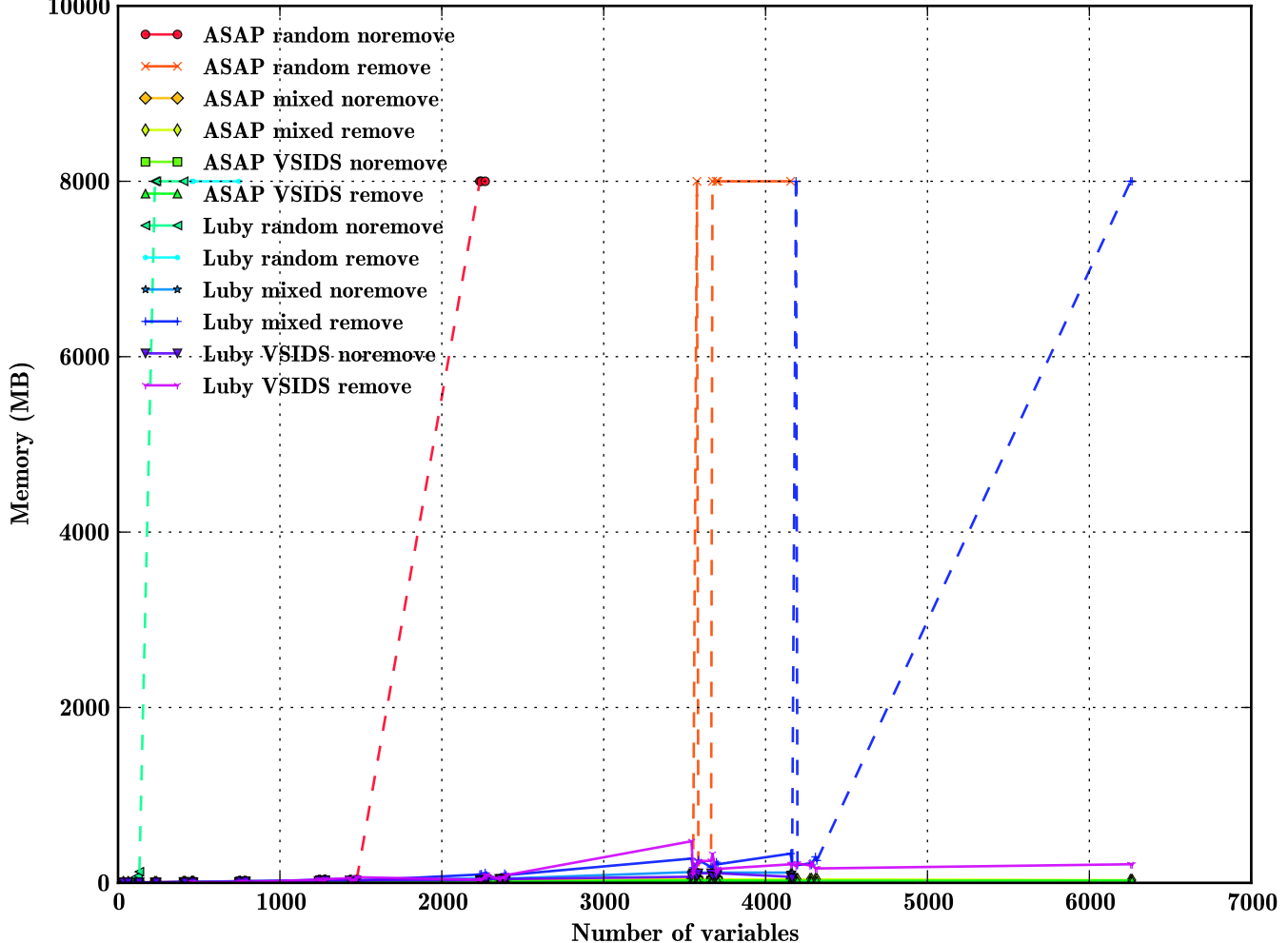




**Memory consumption  
linlin scale**

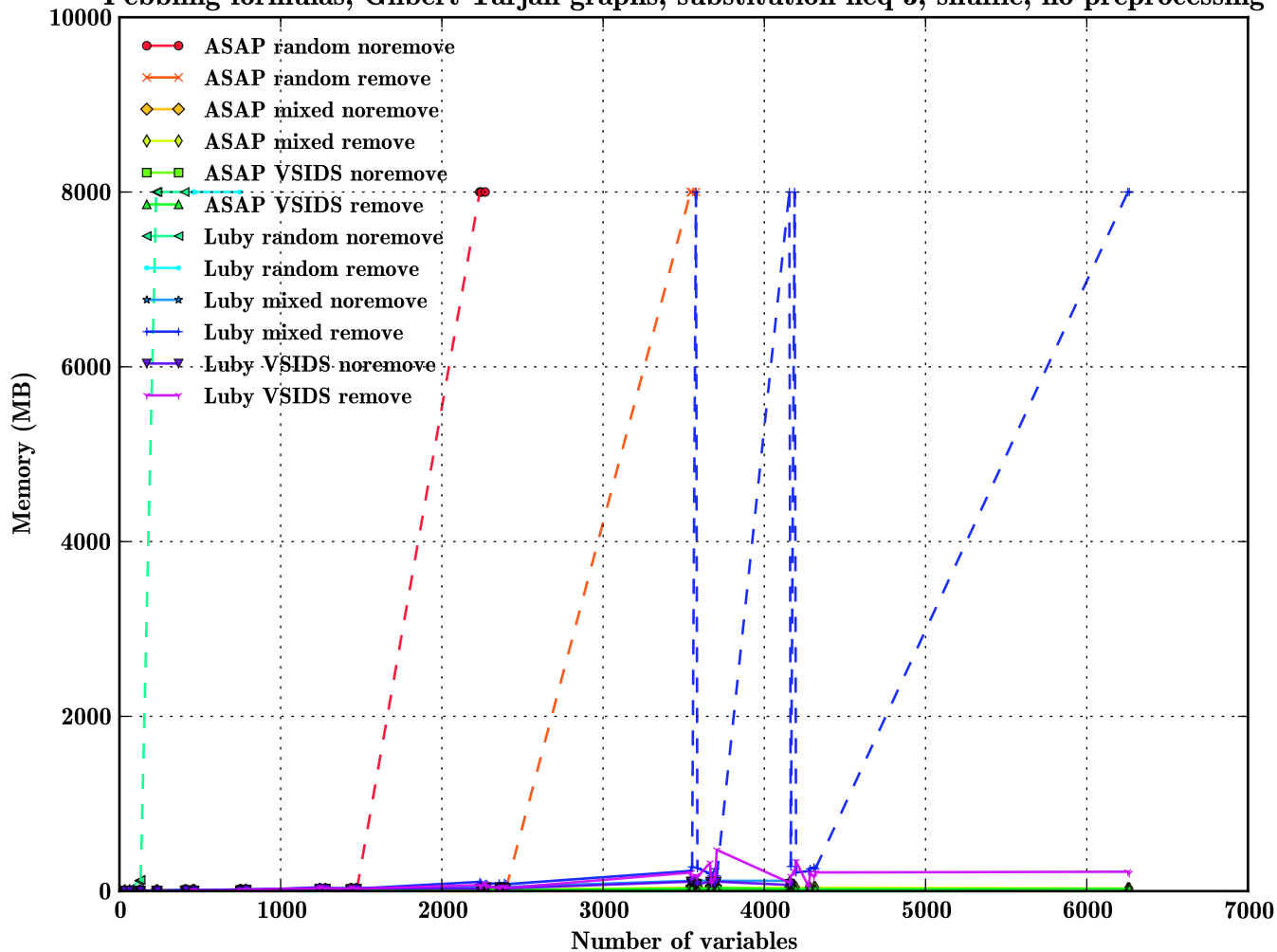
**Pebbling formulas with  
substitution neq(not all equal)  
of arity 3**

Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, no preprocessing

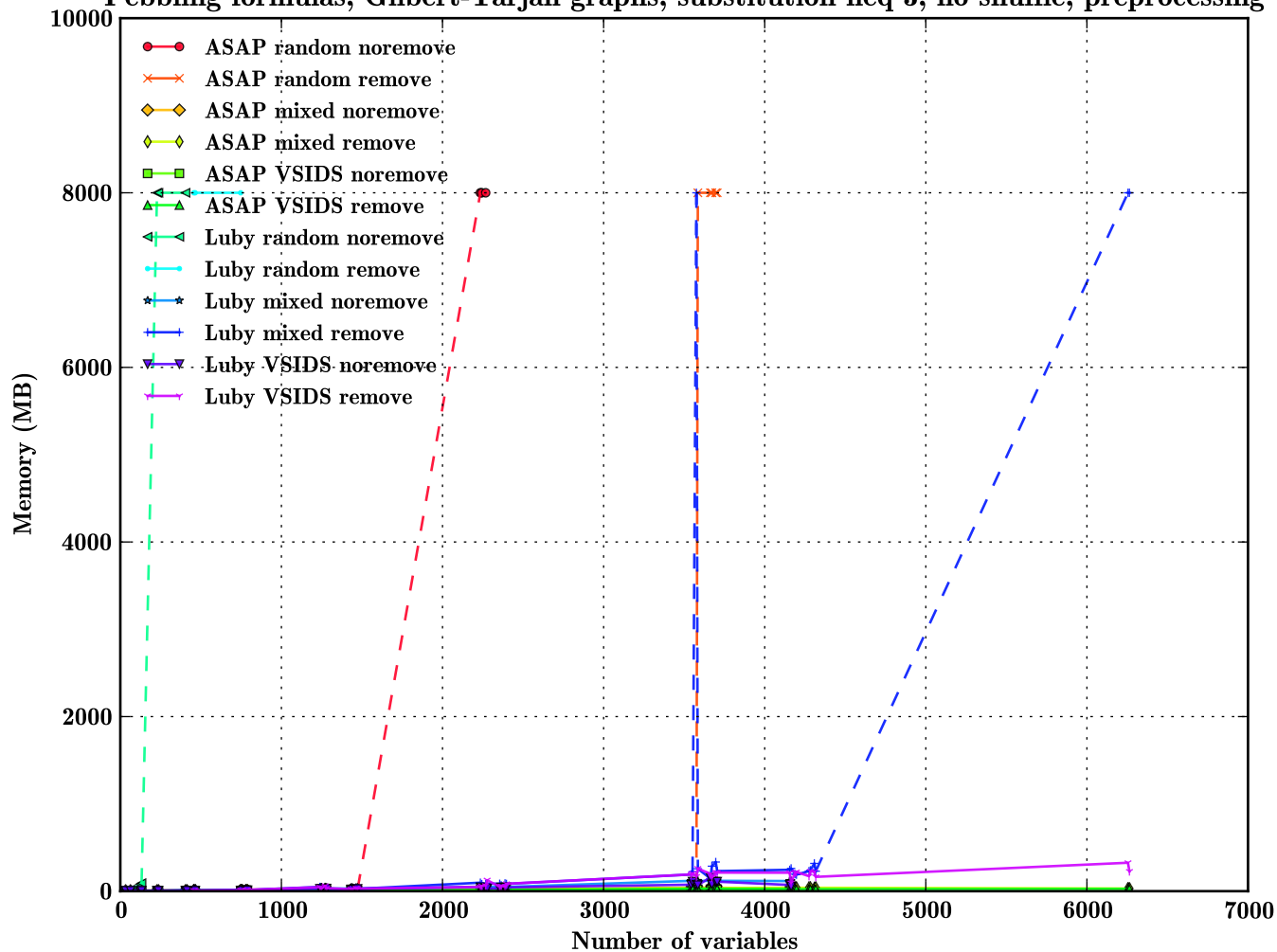




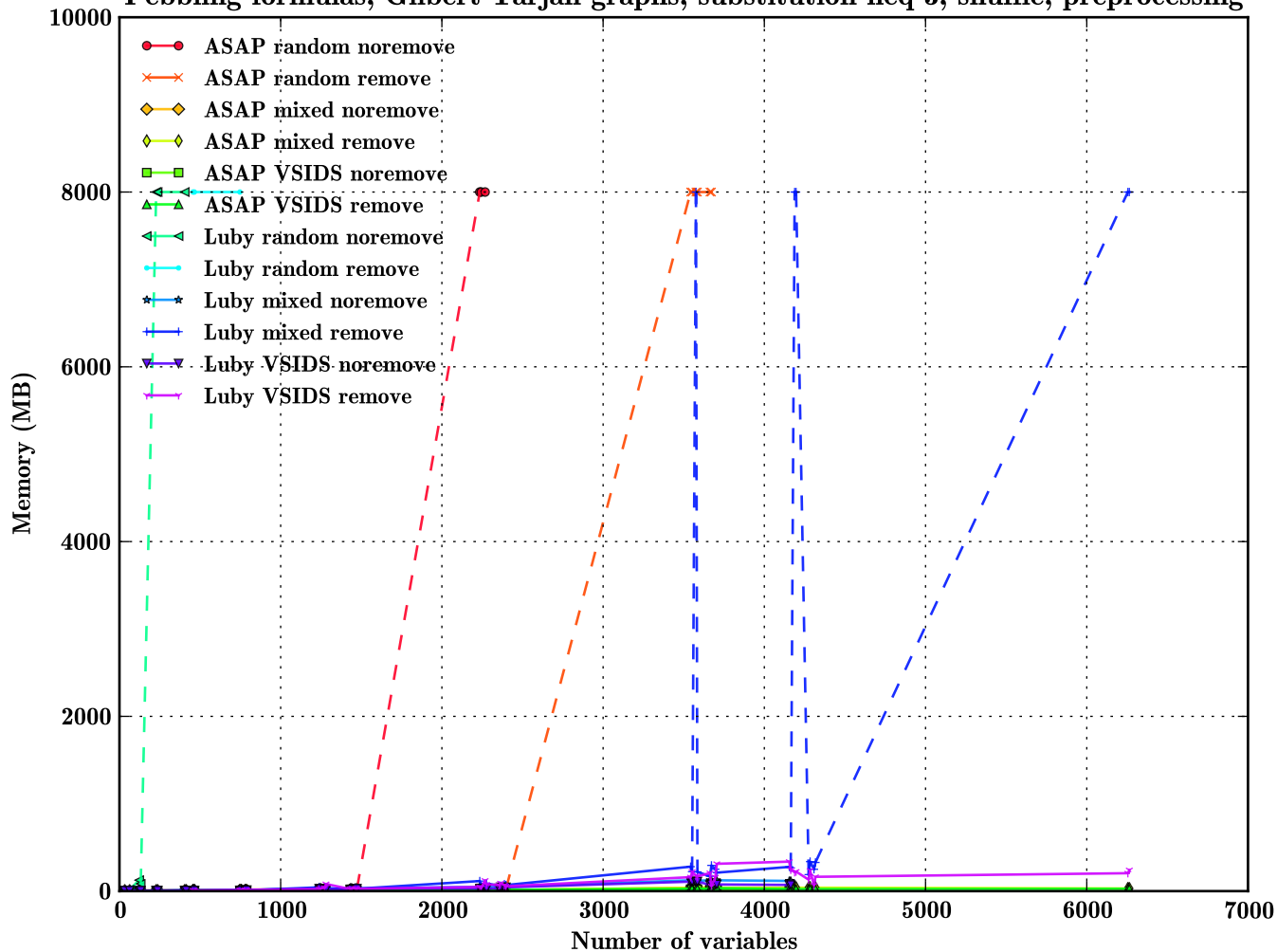
Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, no preprocessing



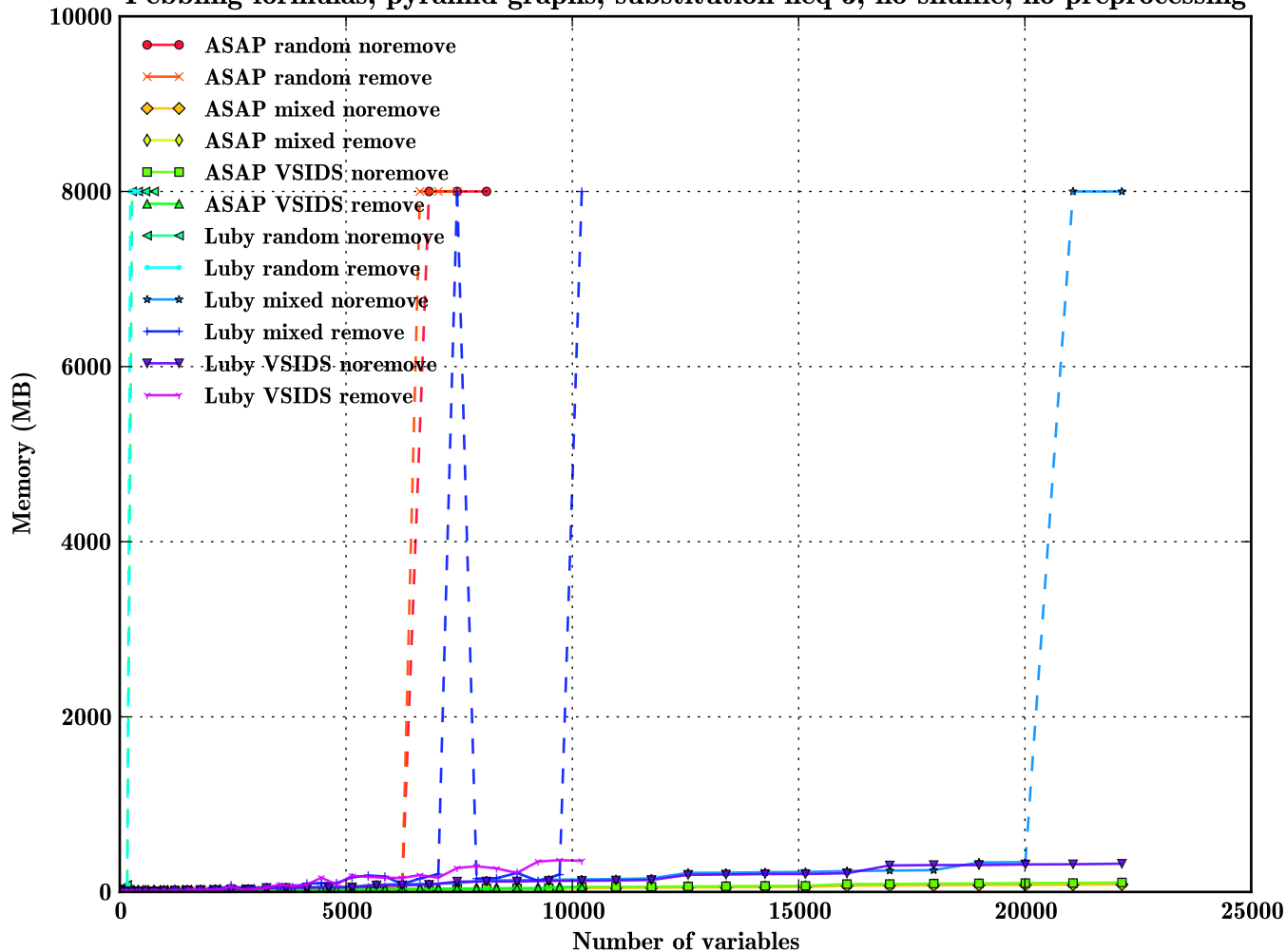
Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, no shuffle, preprocessing



Pebbling formulas, Gilbert-Tarjan graphs, substitution neq 3, shuffle, preprocessing



Pebbling formulas, pyramid graphs, substitution neq 3, no shuffle, no preprocessing

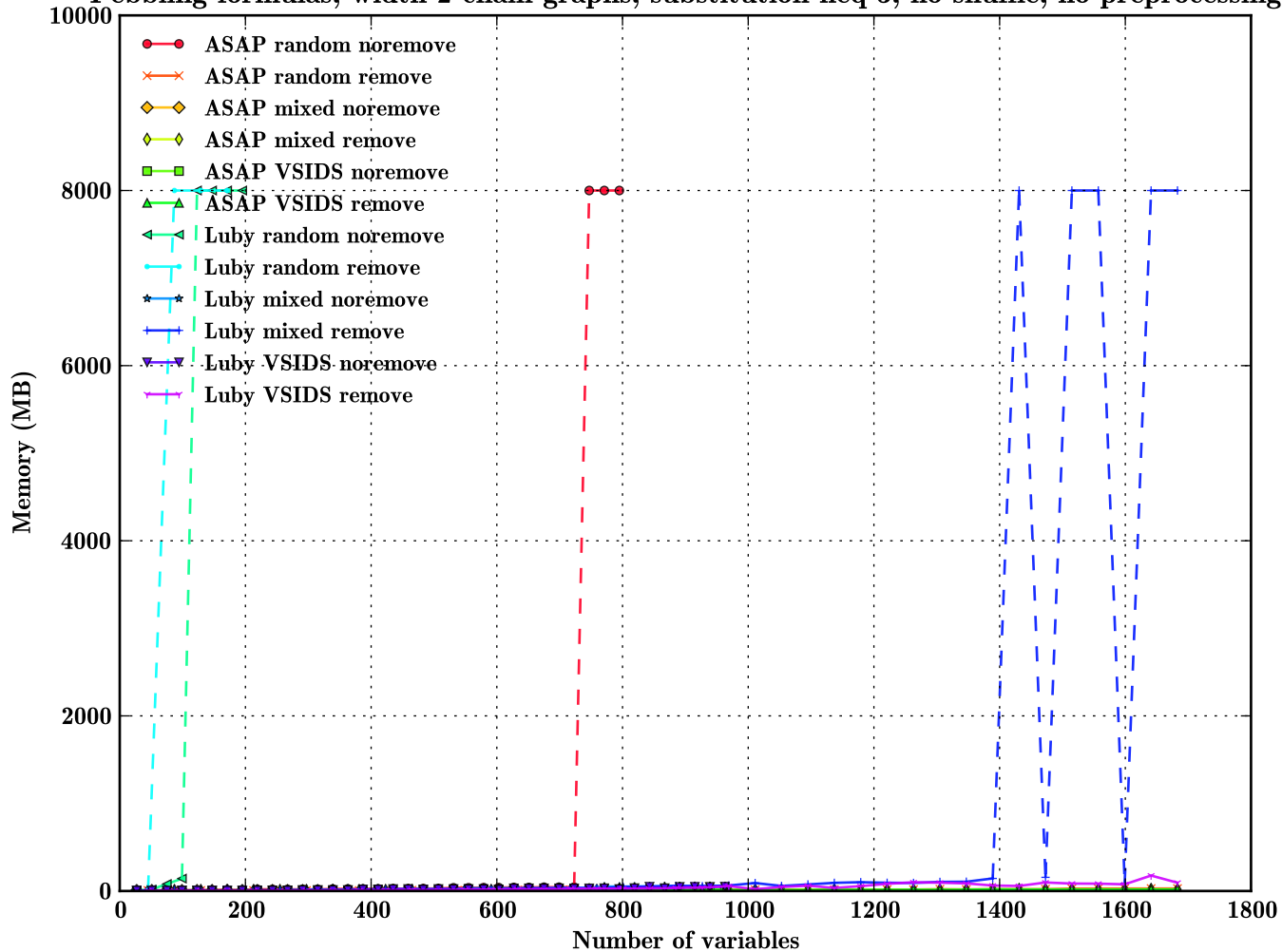






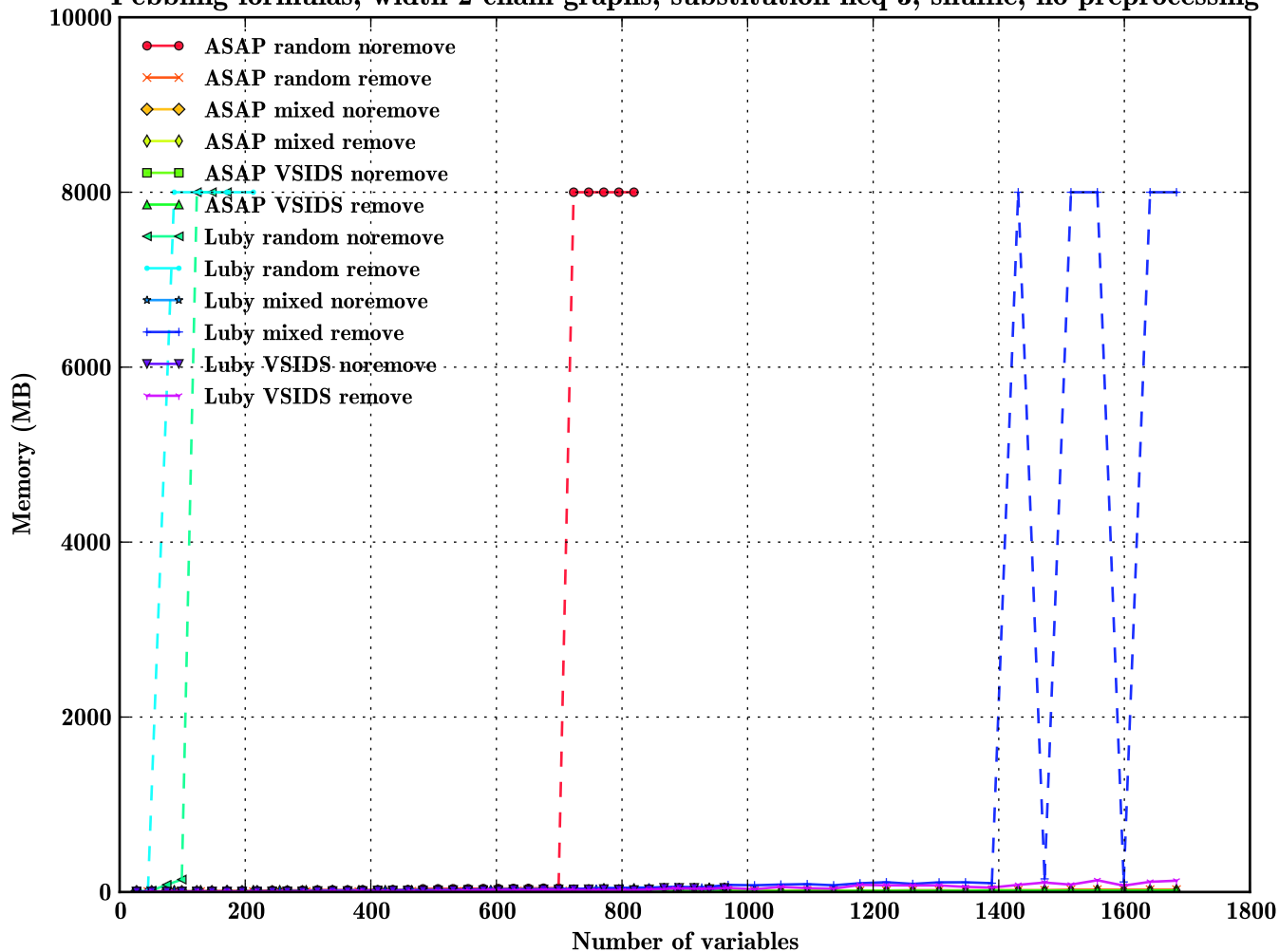


Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, no preprocessing

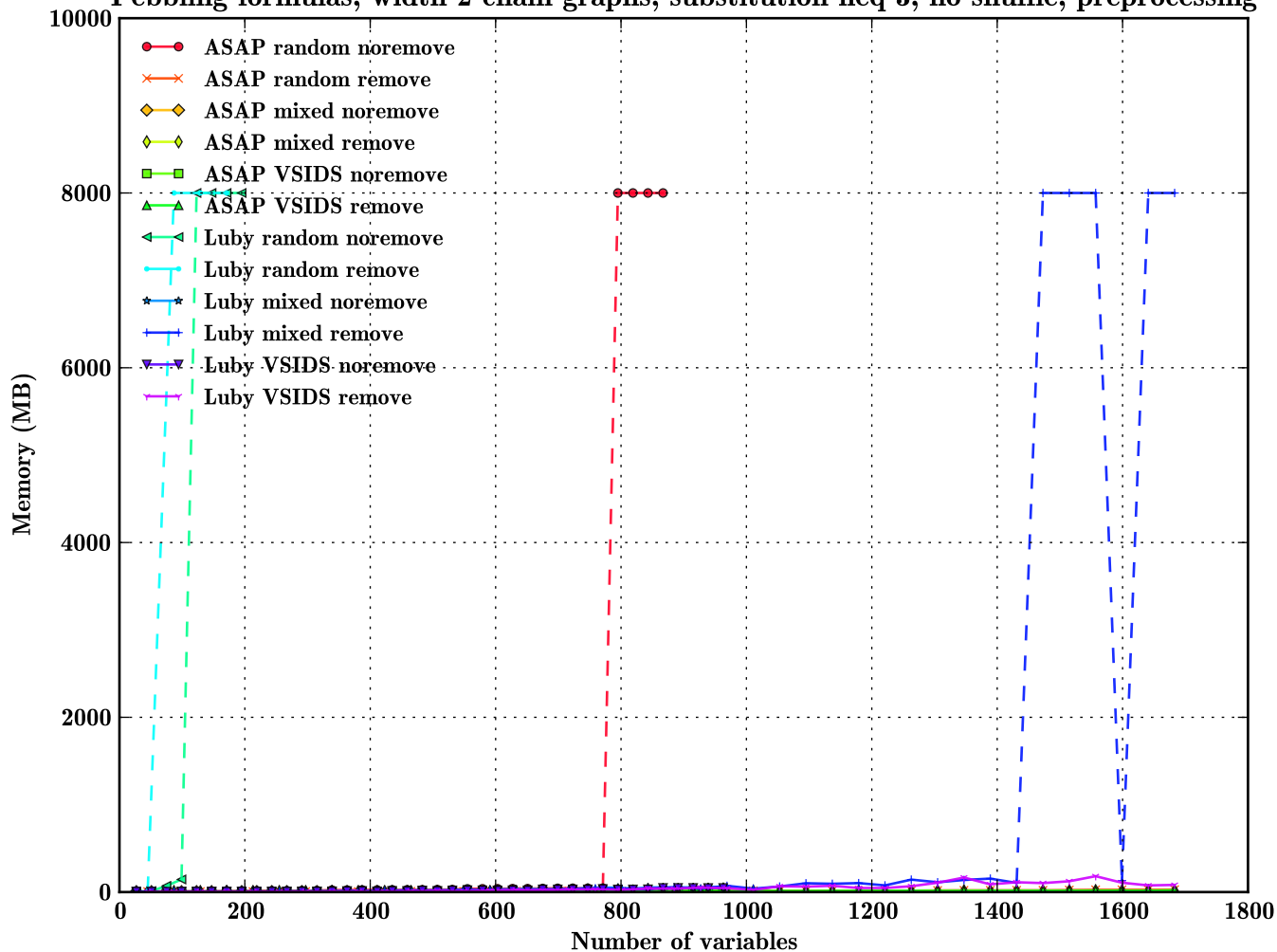




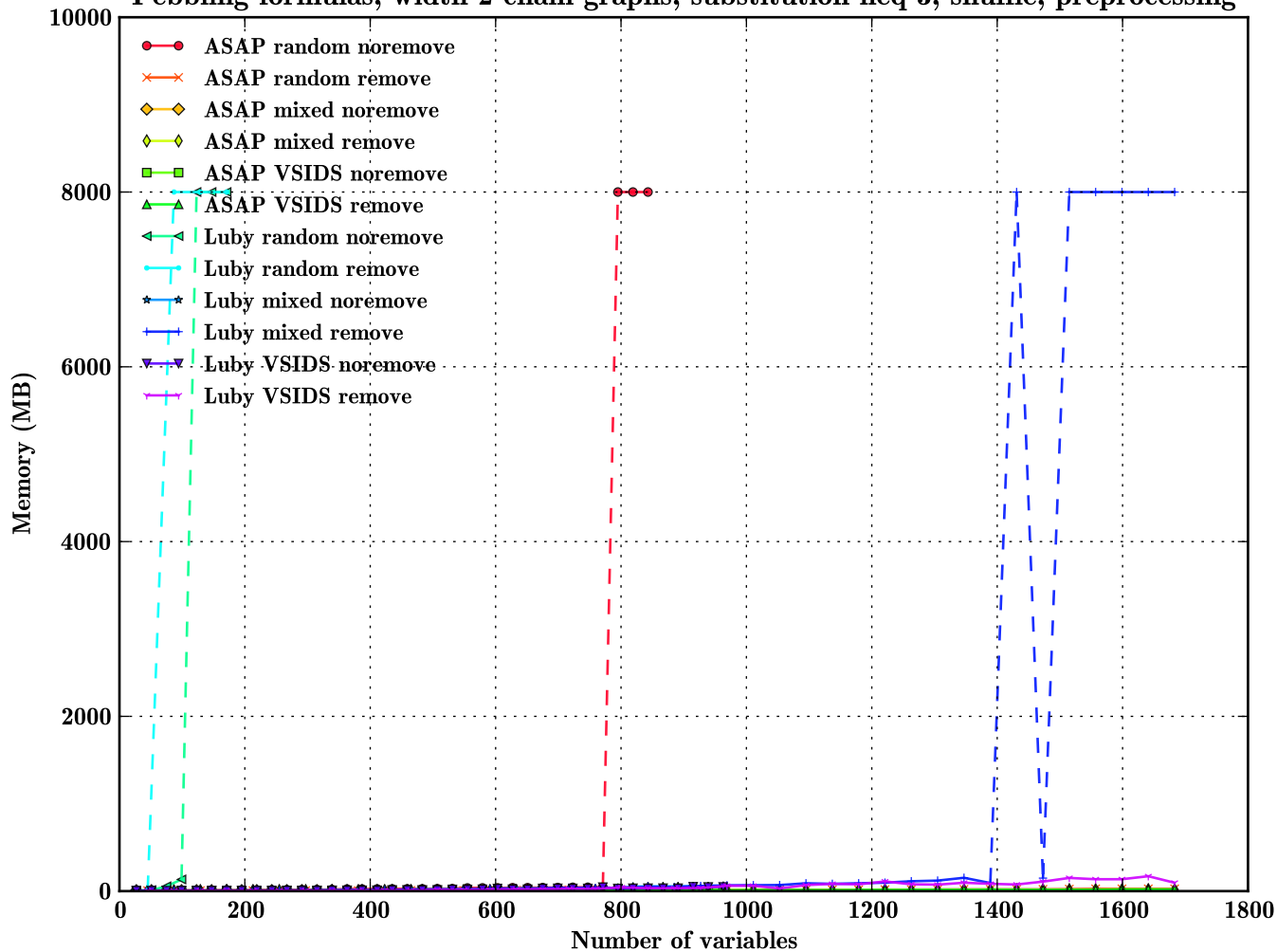
Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, no preprocessing



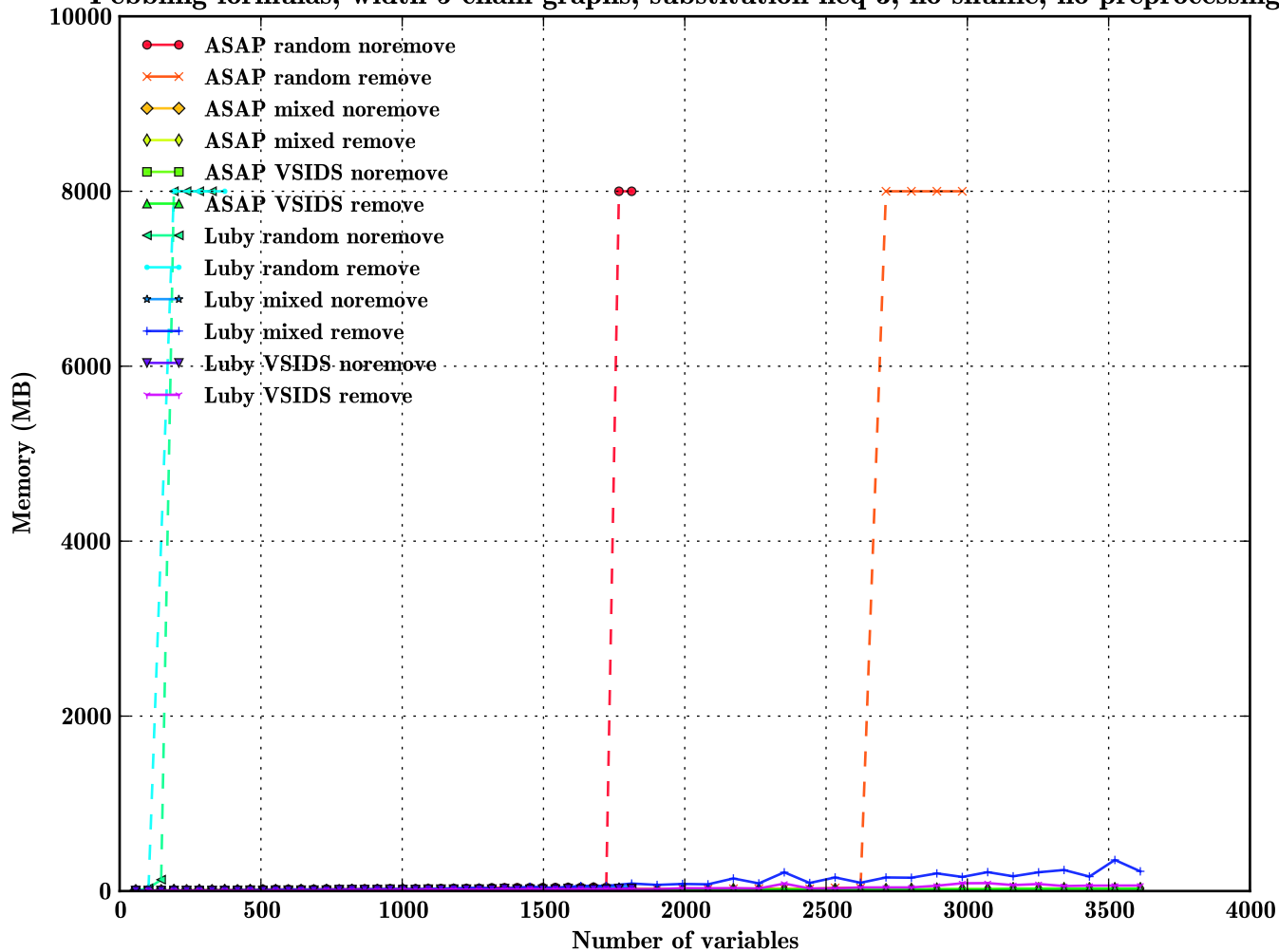
Pebbling formulas, width 2 chain graphs, substitution neq 3, no shuffle, preprocessing



Pebbling formulas, width 2 chain graphs, substitution neq 3, shuffle, preprocessing

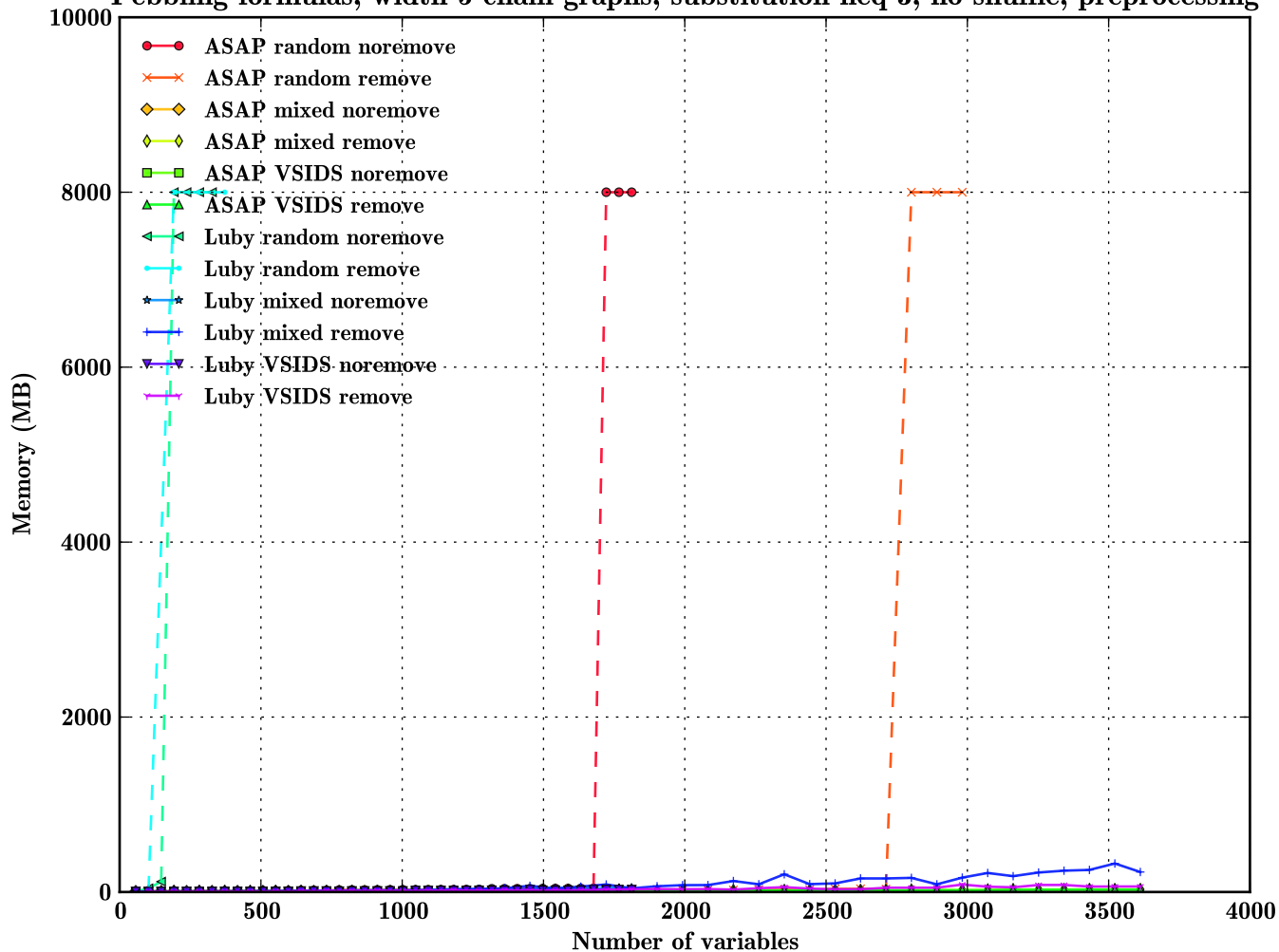


Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, no preprocessing





Pebbling formulas, width 5 chain graphs, substitution neq 3, no shuffle, preprocessing



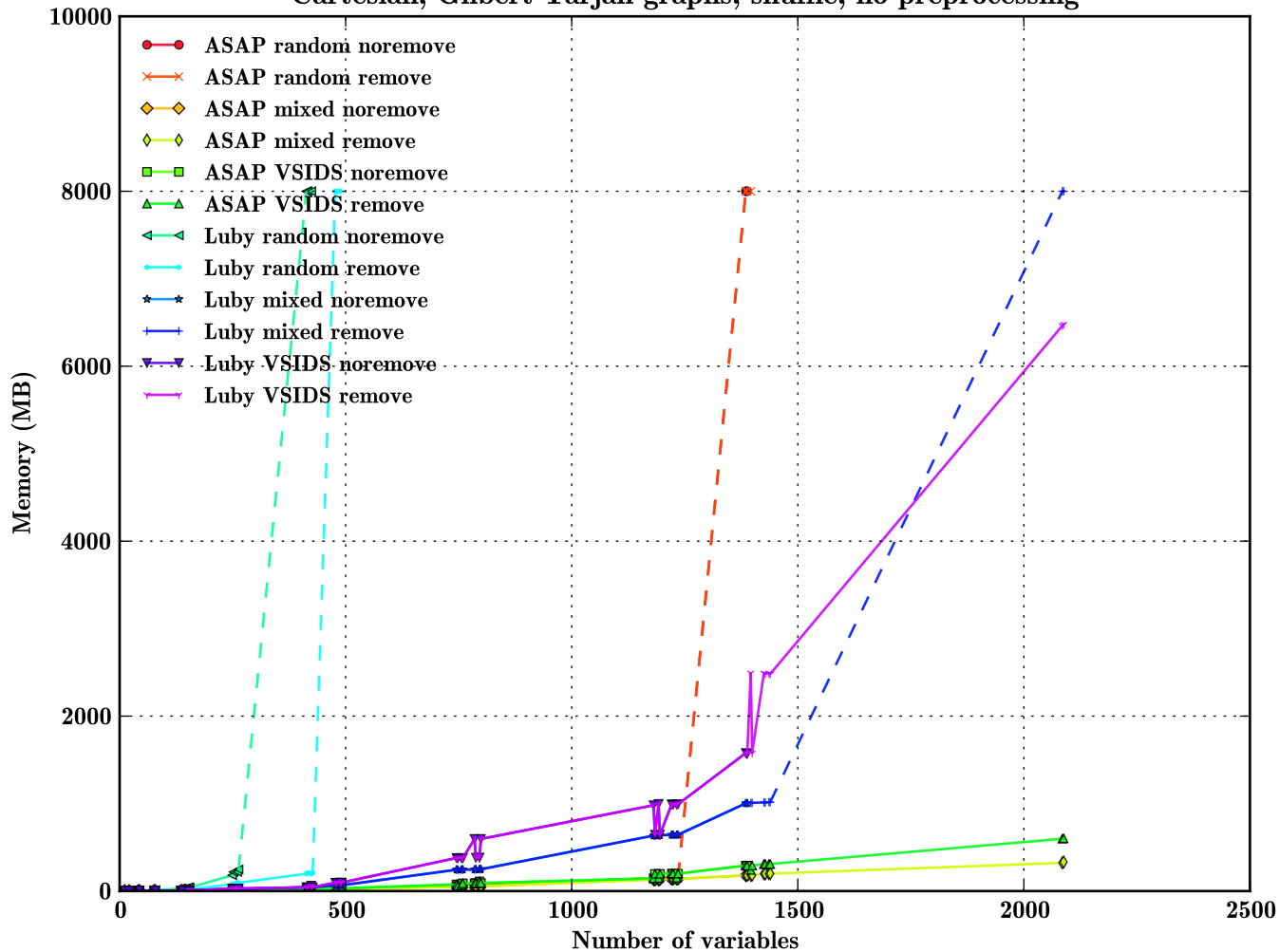


# **Cartesian products of vanilla pebbling formulas**





Cartesian, Gilbert-Tarjan graphs, shuffle, no preprocessing





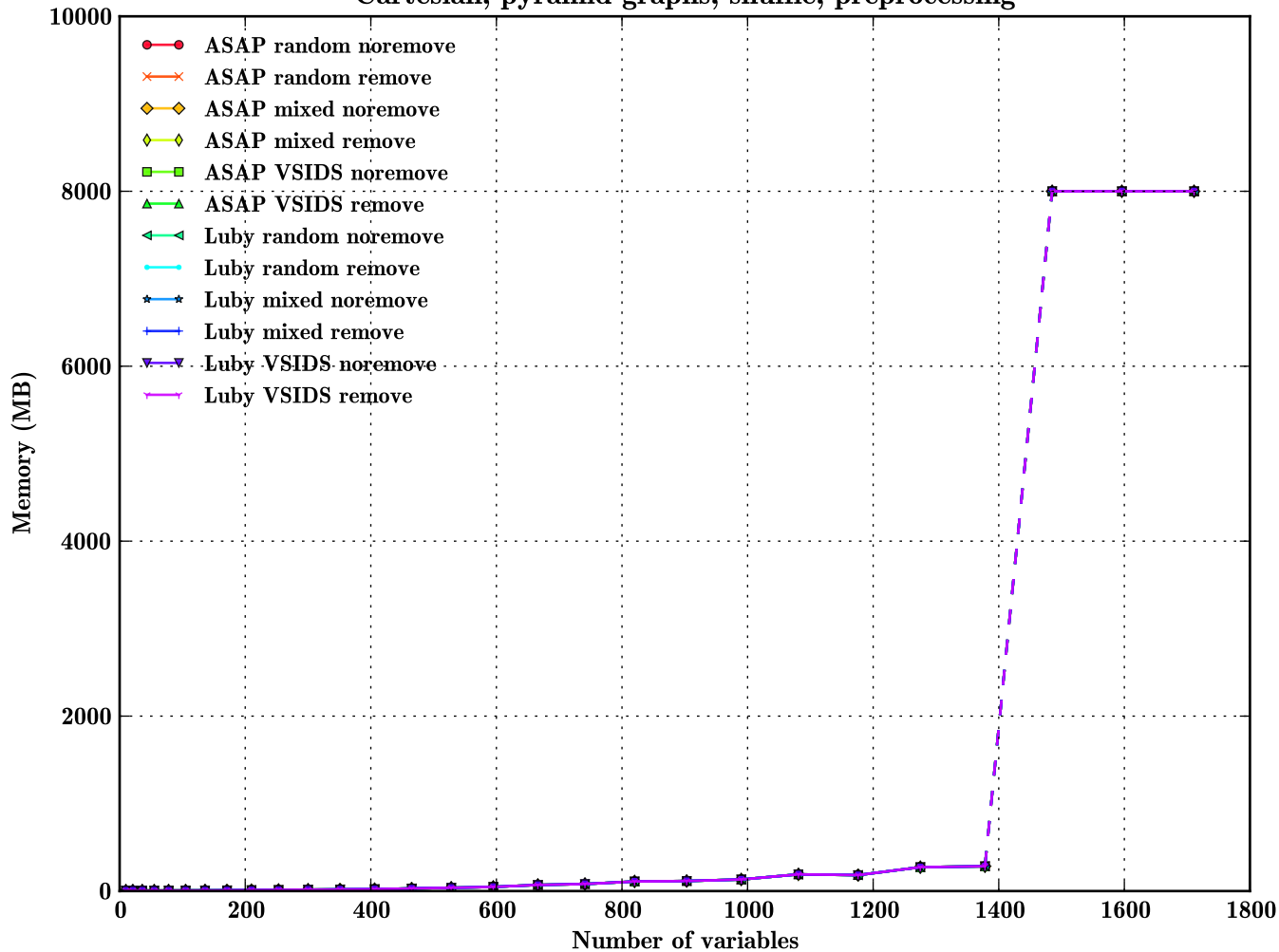








Cartesian, pyramid graphs, shuffle, preprocessing

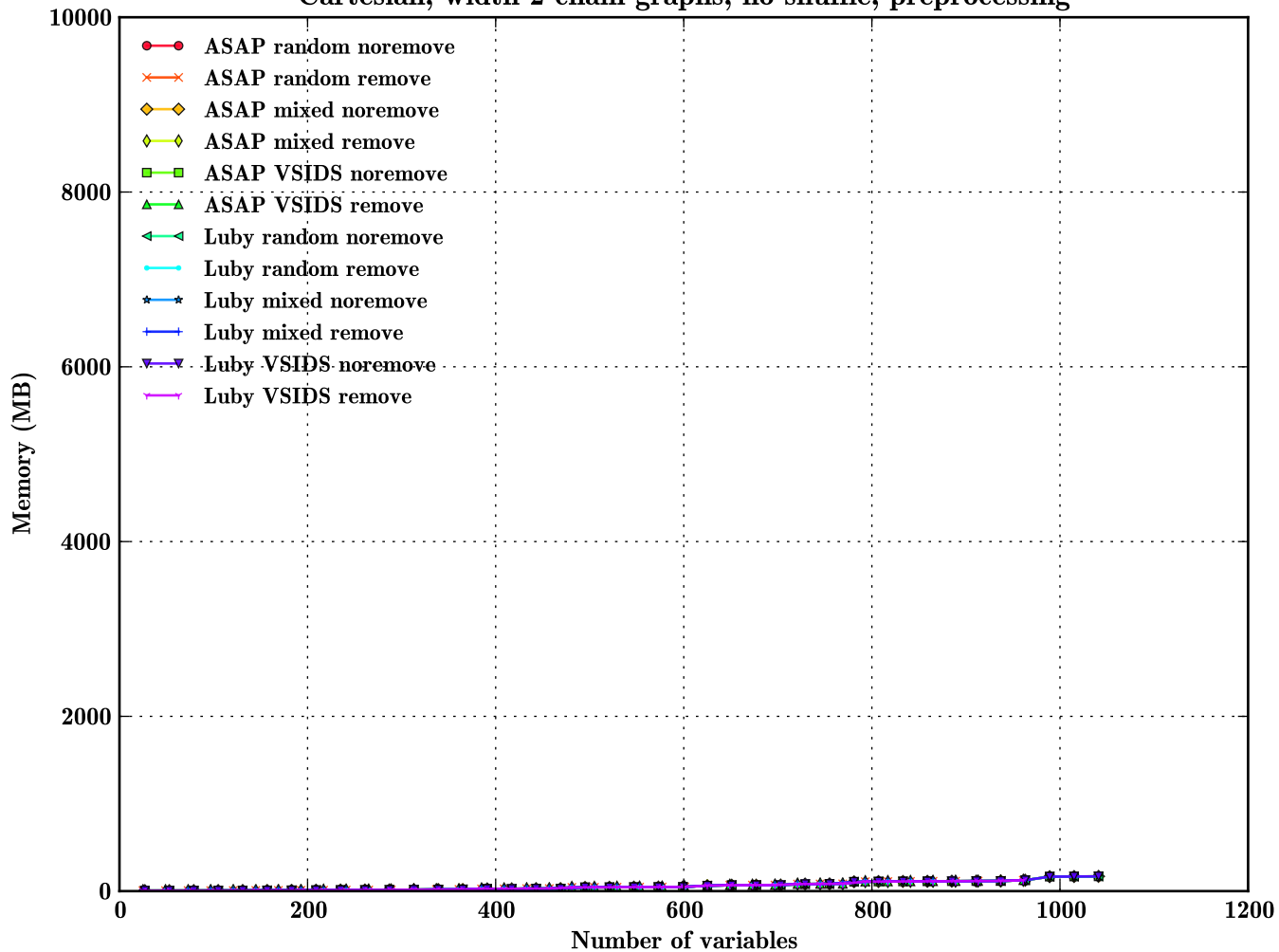






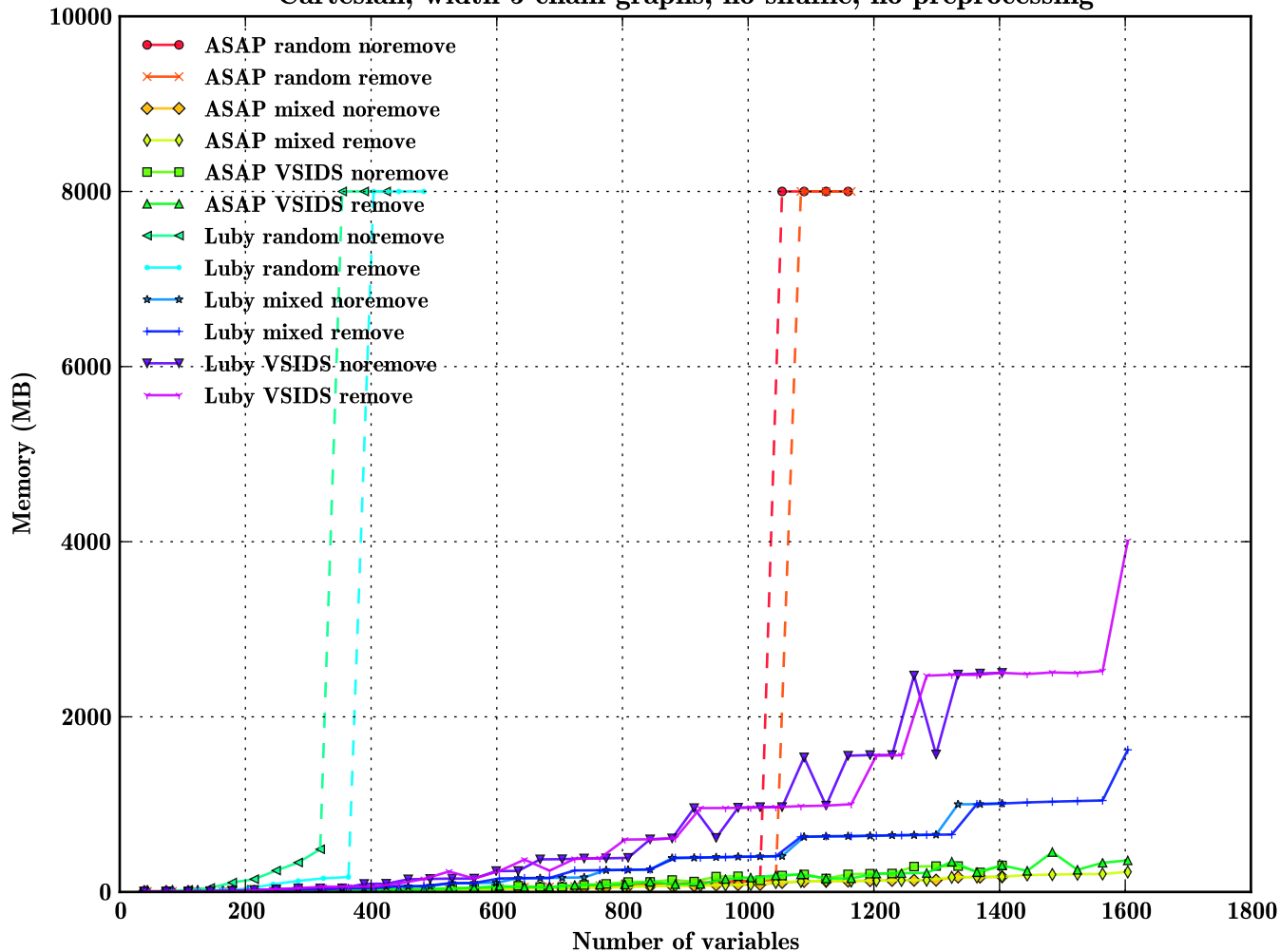


Cartesian, width 2 chain graphs, no shuffle, preprocessing





Cartesian, width 5 chain graphs, no shuffle, no preprocessing









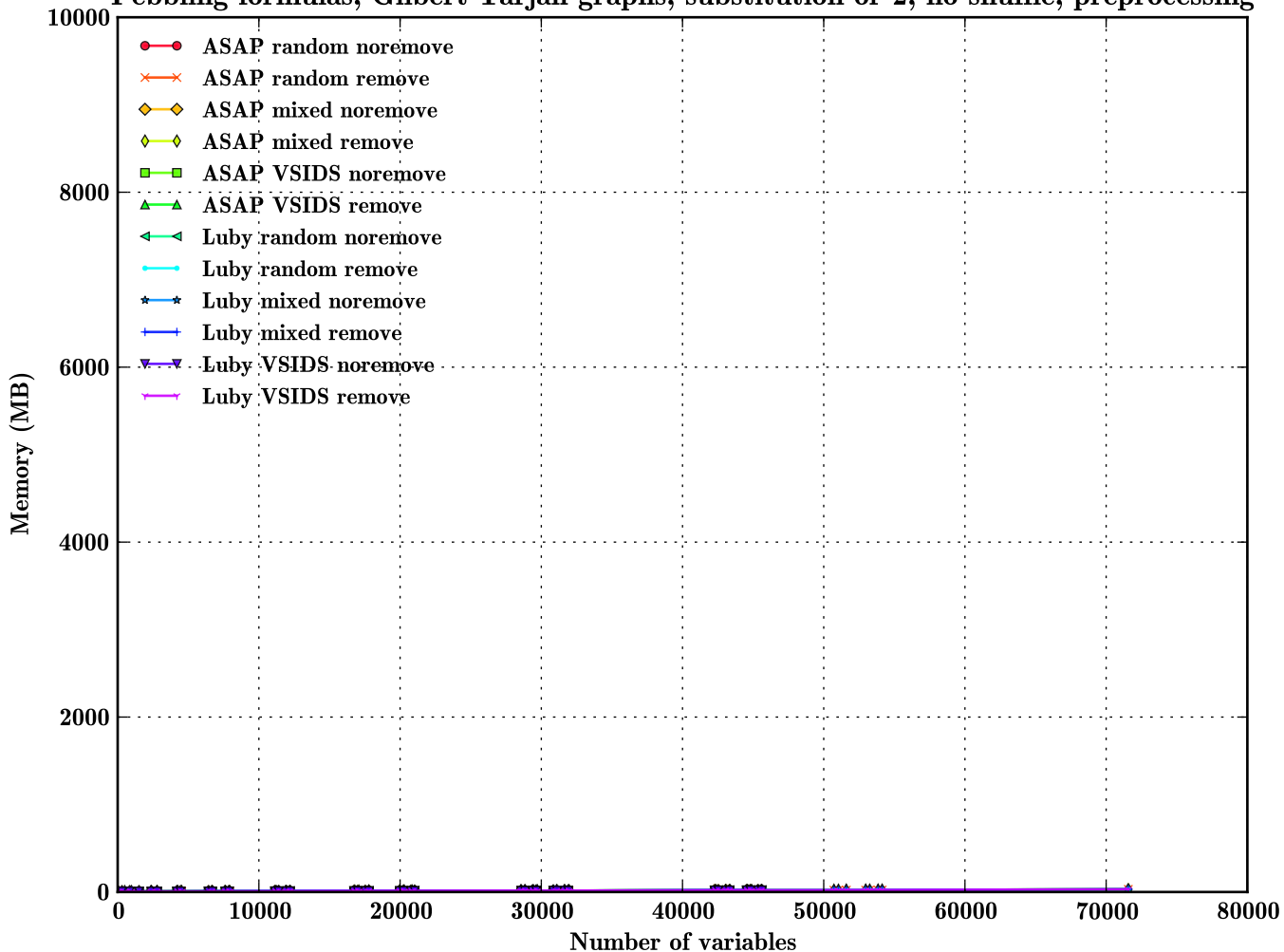


# **Pebbling formulas with substitution or of arity 2**

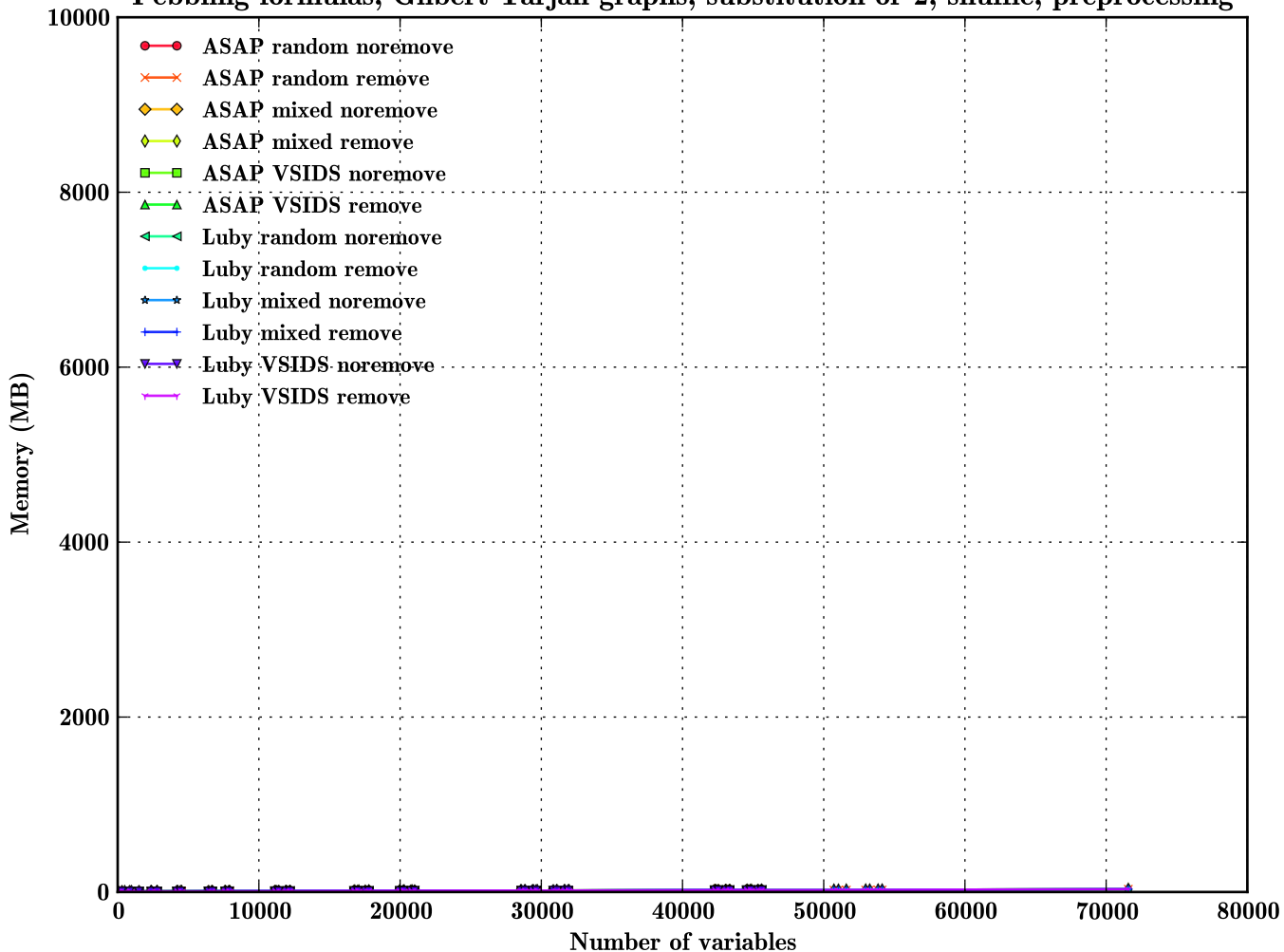




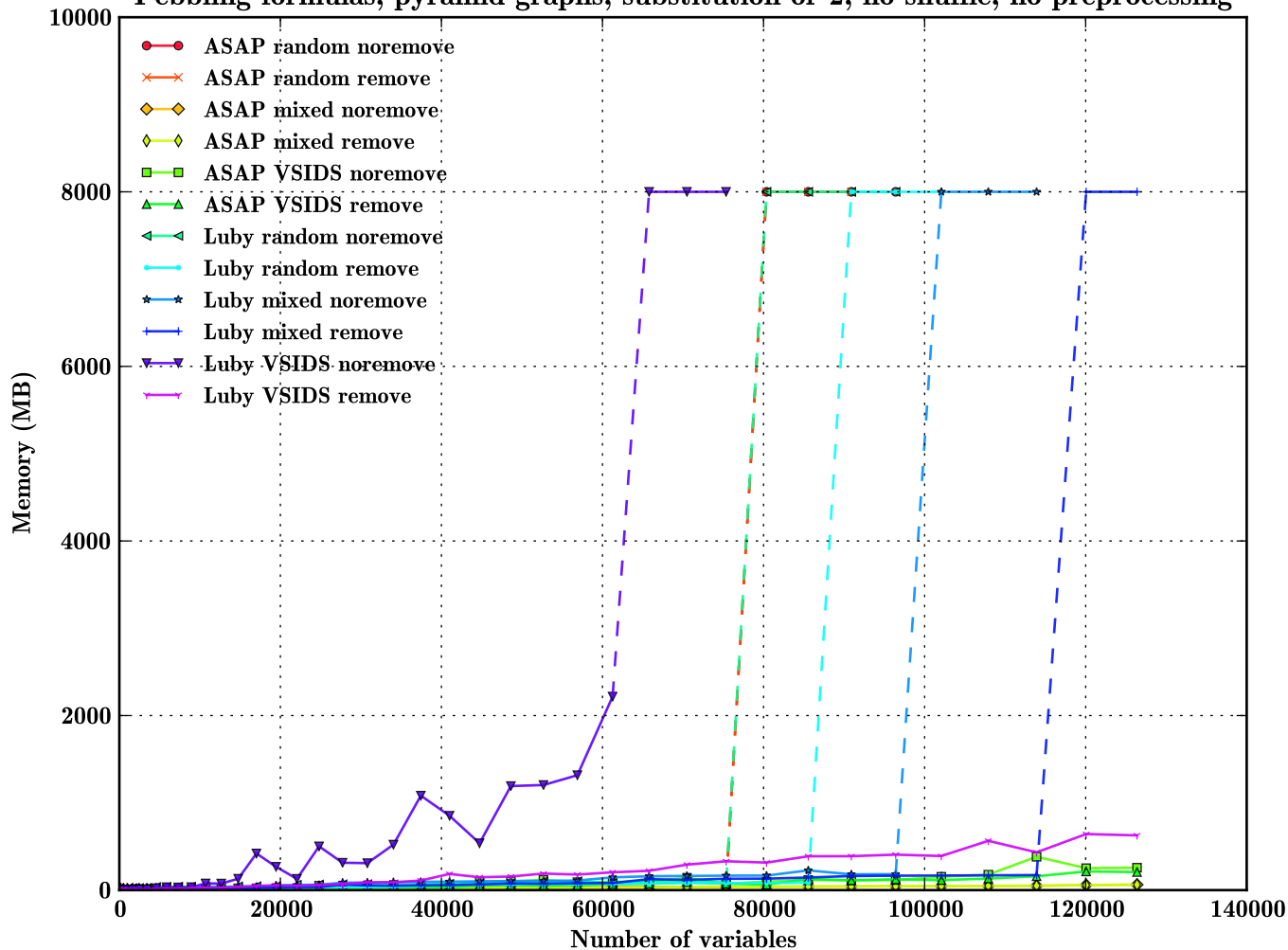
# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, no shuffle, preprocessing



# Pebbling formulas, Gilbert-Tarjan graphs, substitution or 2, shuffle, preprocessing



Pebbling formulas, pyramid graphs, substitution or 2, no shuffle, no preprocessing



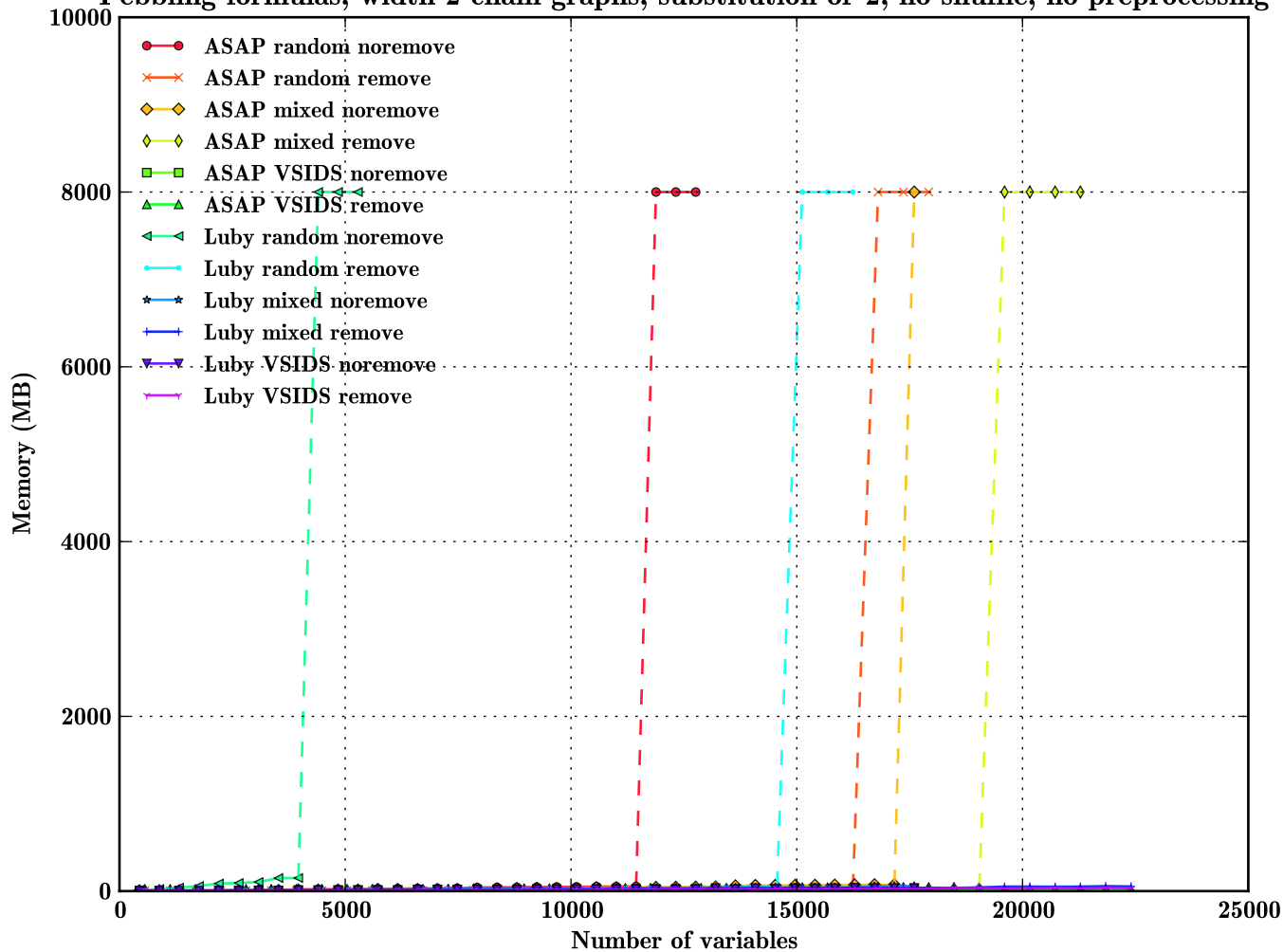




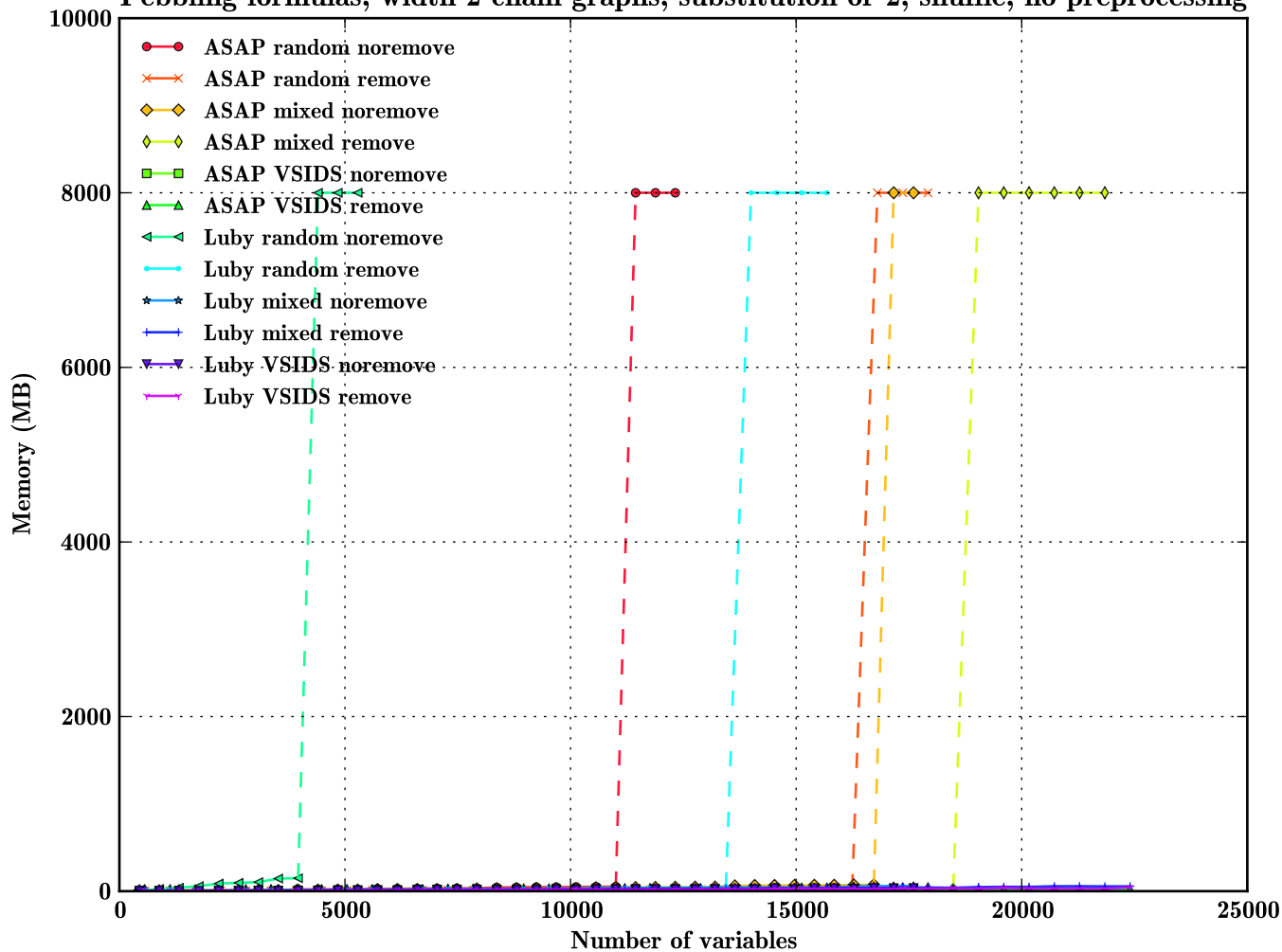




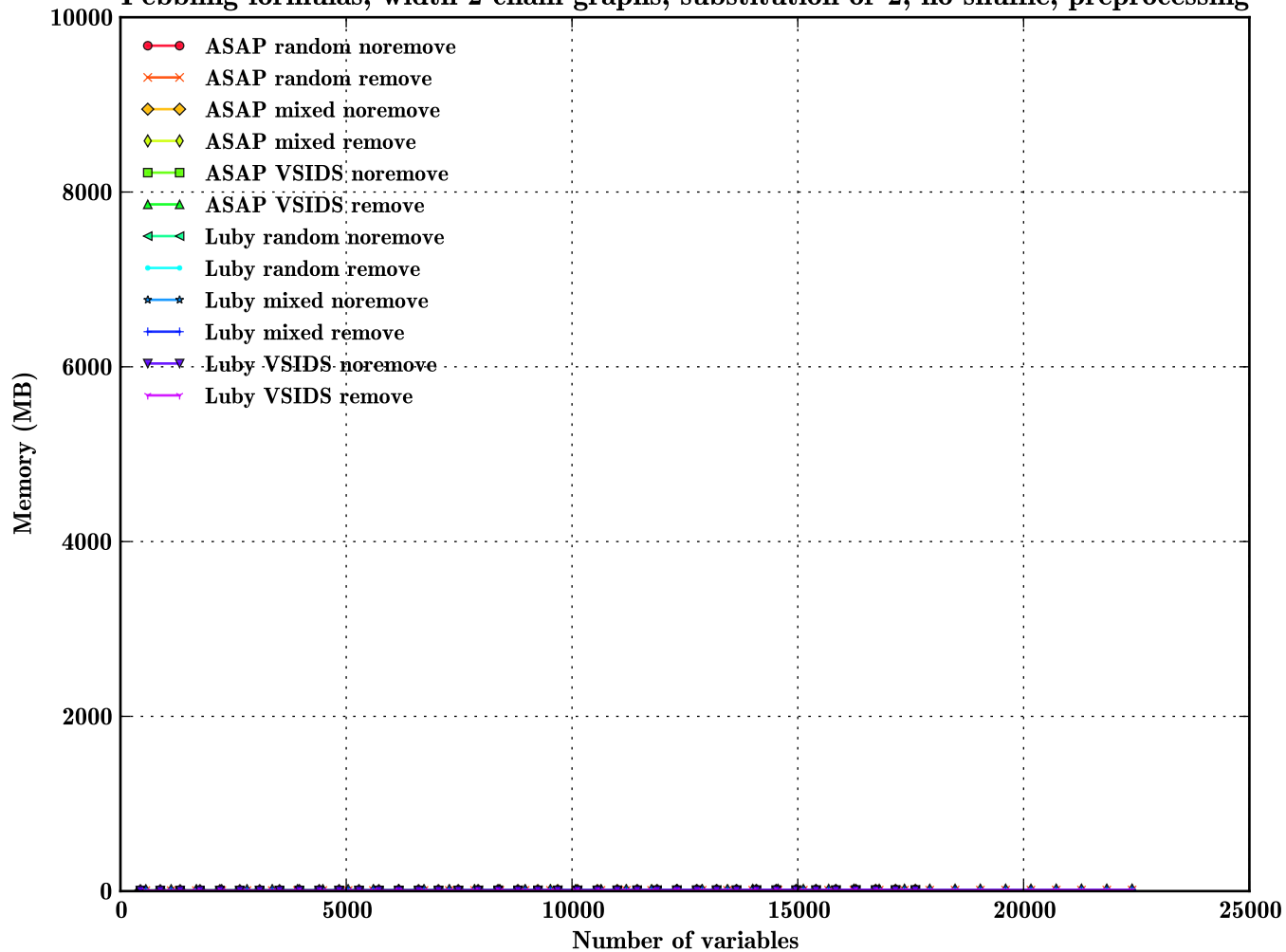
Pebbling formulas, width 2 chain graphs, substitution or 2, no shuffle, no preprocessing



Pebbling formulas, width 2 chain graphs, substitution or 2, shuffle, no preprocessing

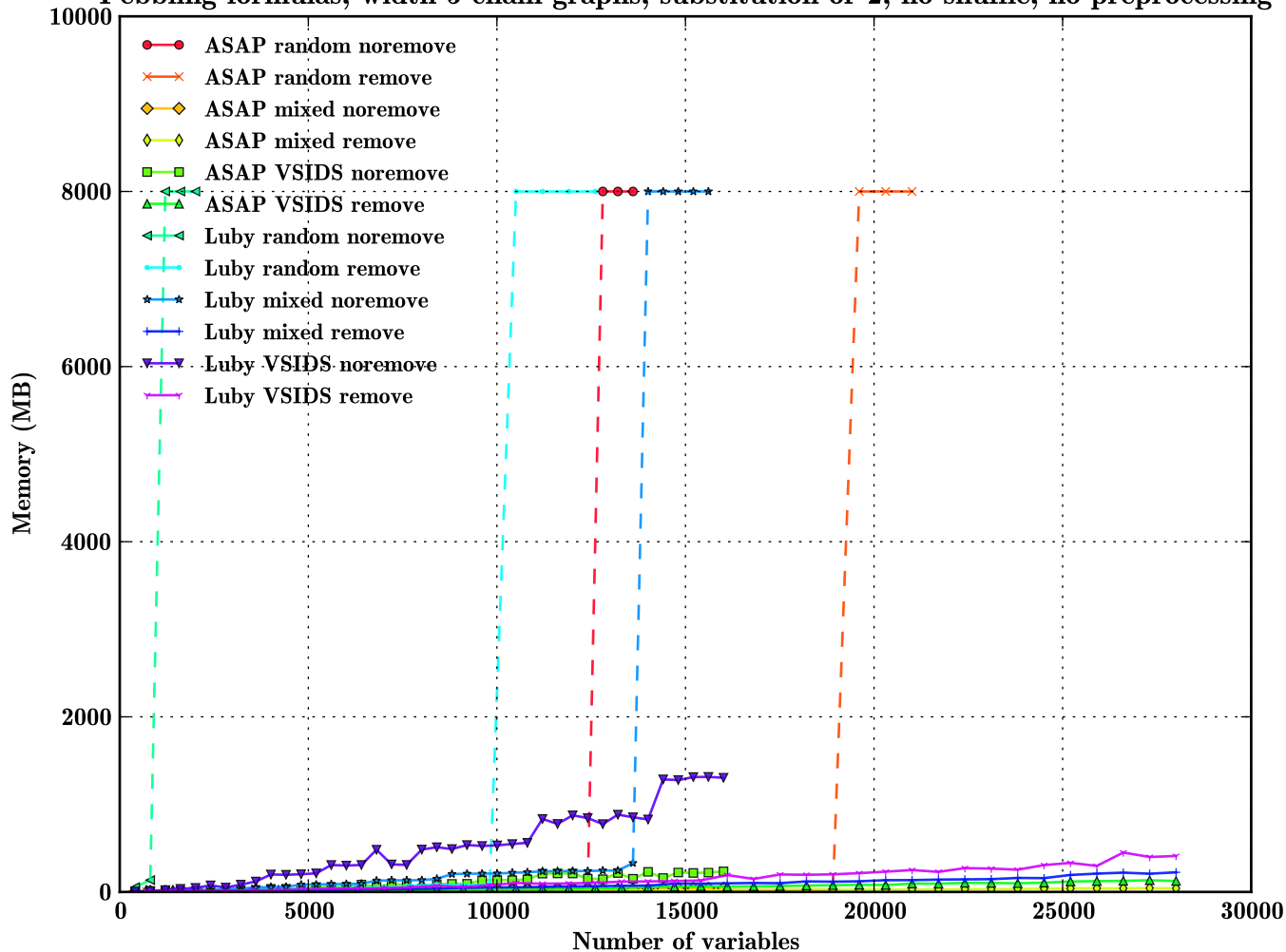


Pebbling formulas, width 2 chain graphs, substitution or 2, no shuffle, preprocessing

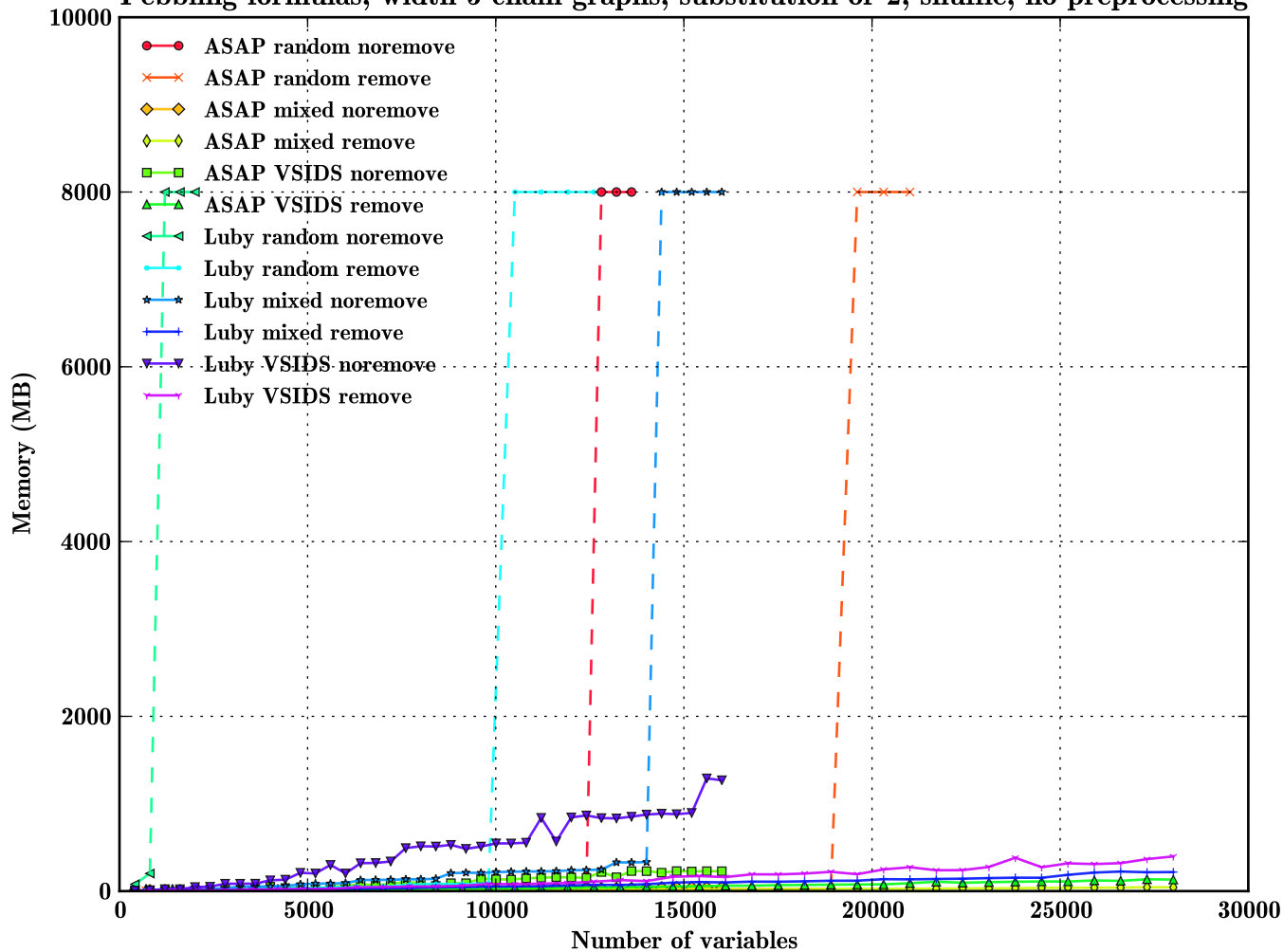




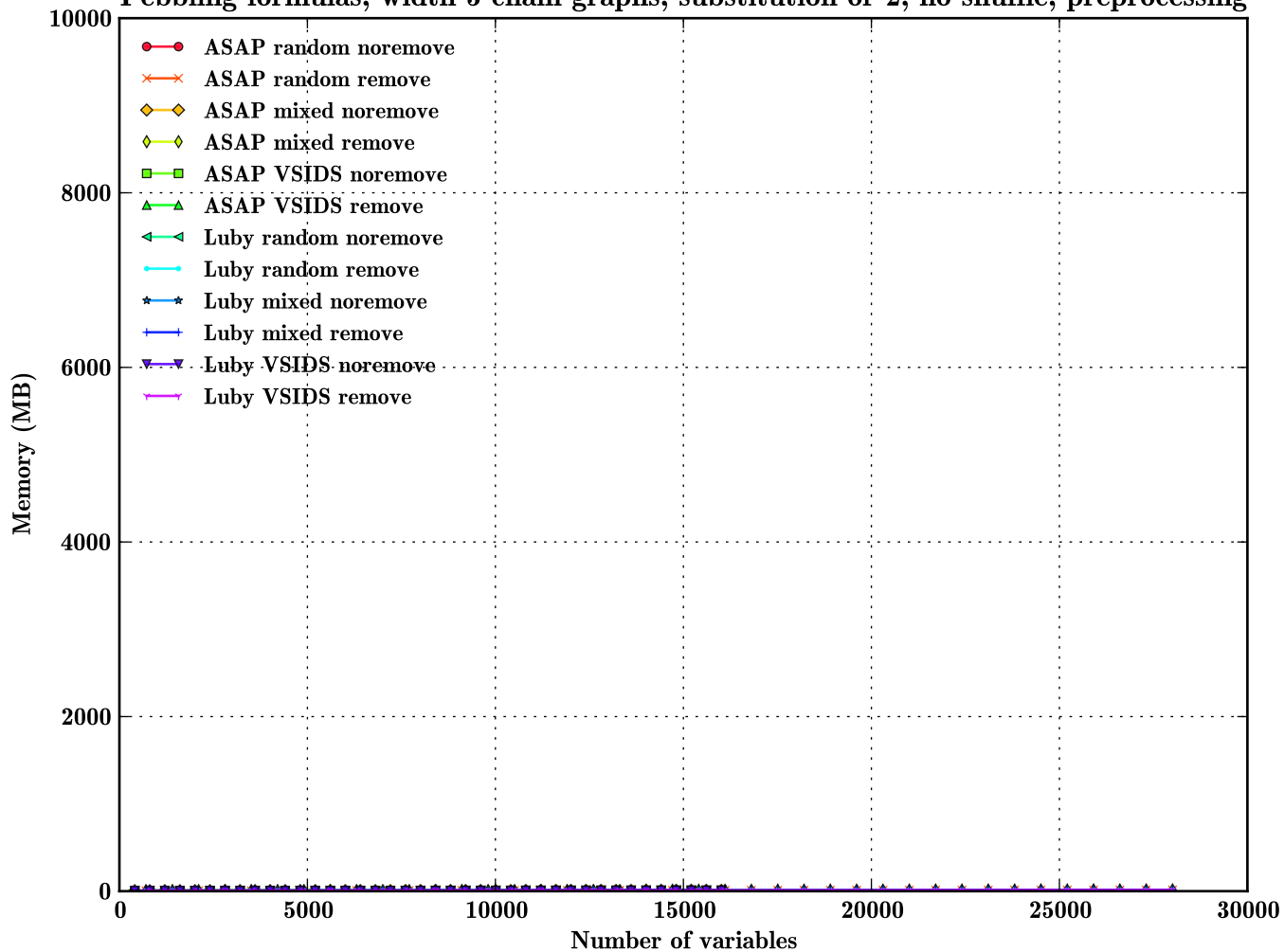
Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, no preprocessing



Pebbling formulas, width 5 chain graphs, substitution or 2, shuffle, no preprocessing



Pebbling formulas, width 5 chain graphs, substitution or 2, no shuffle, preprocessing





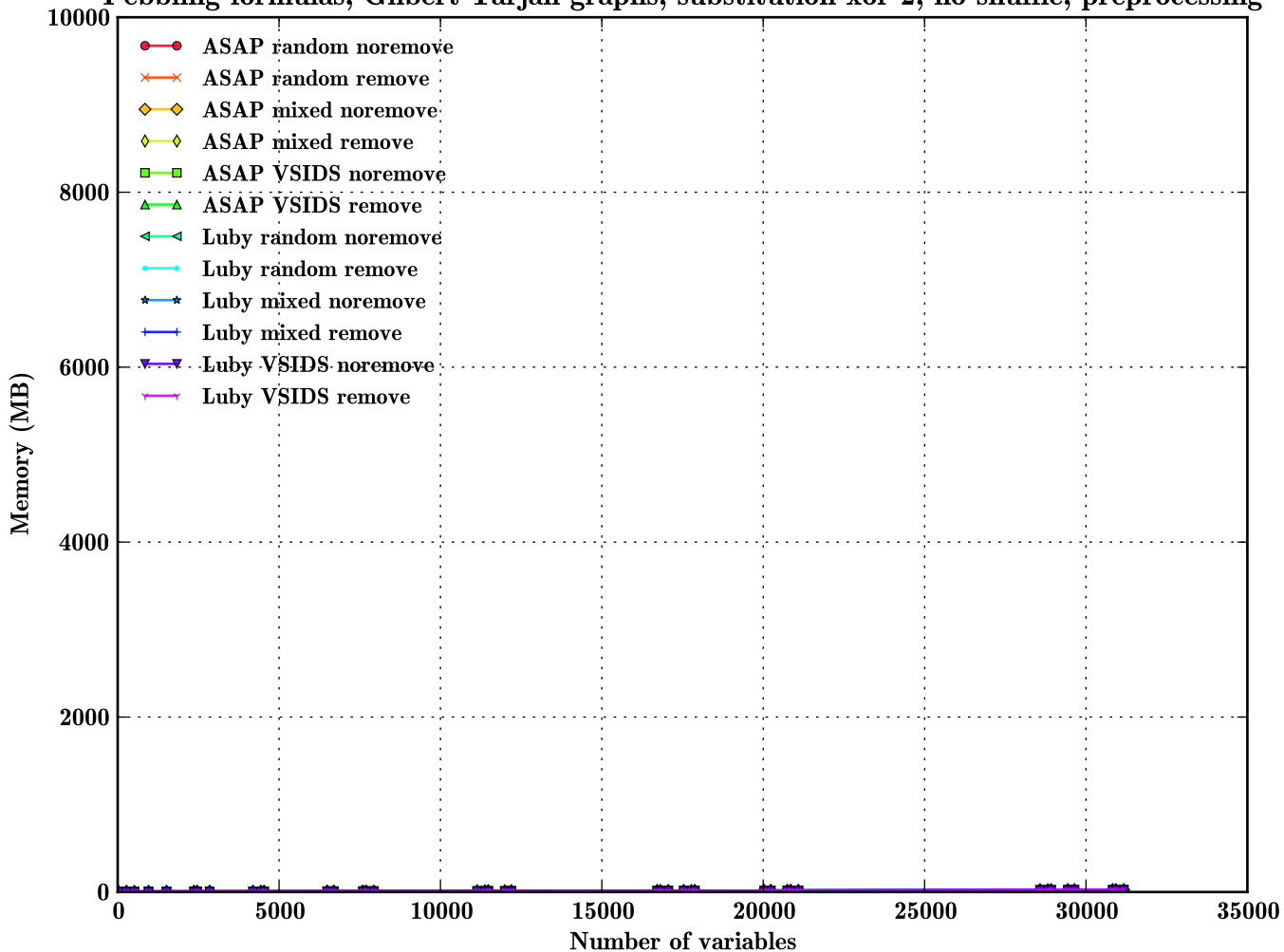


# **Pebbling formulas with substitution xor of arity 2**

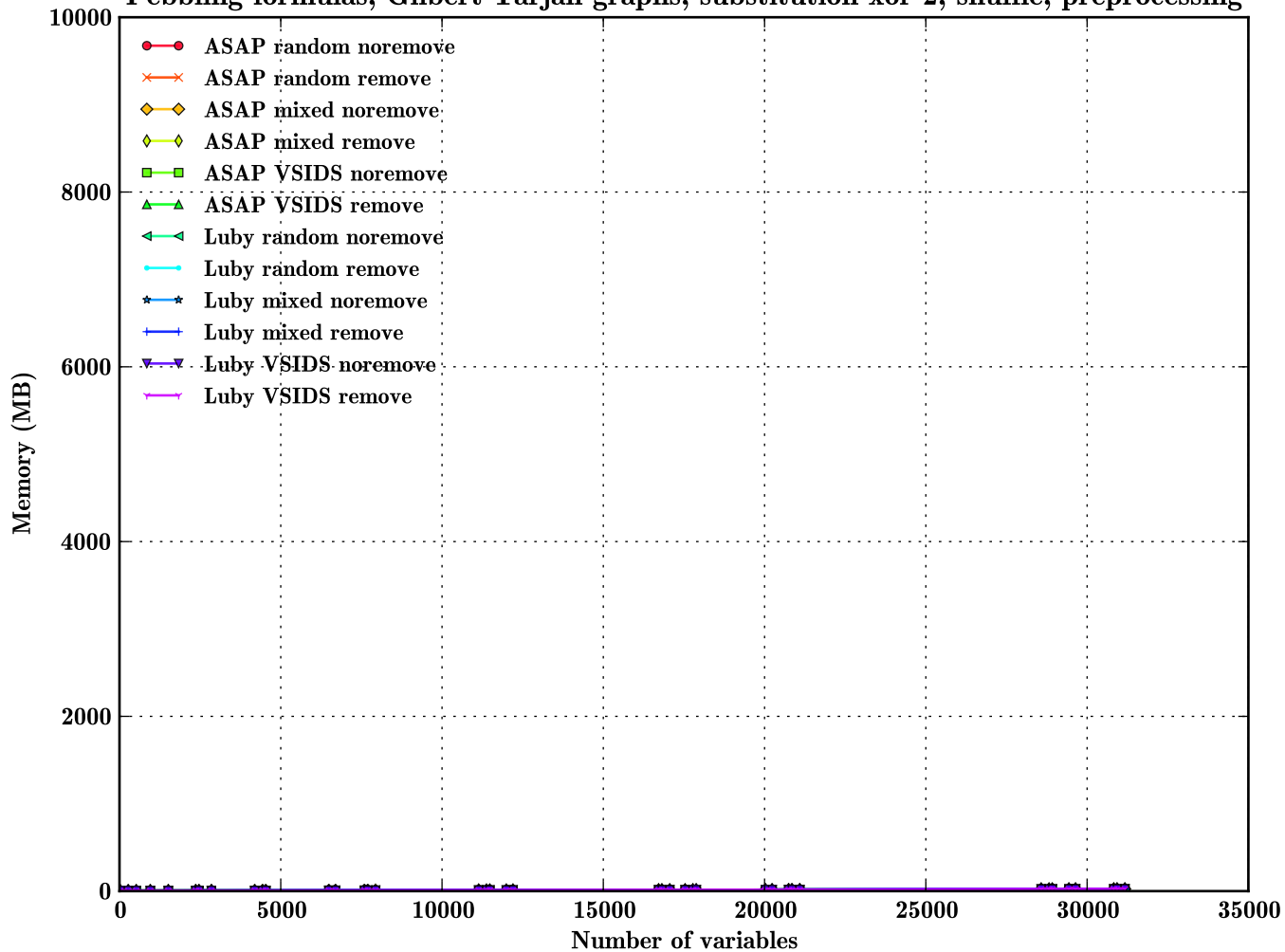




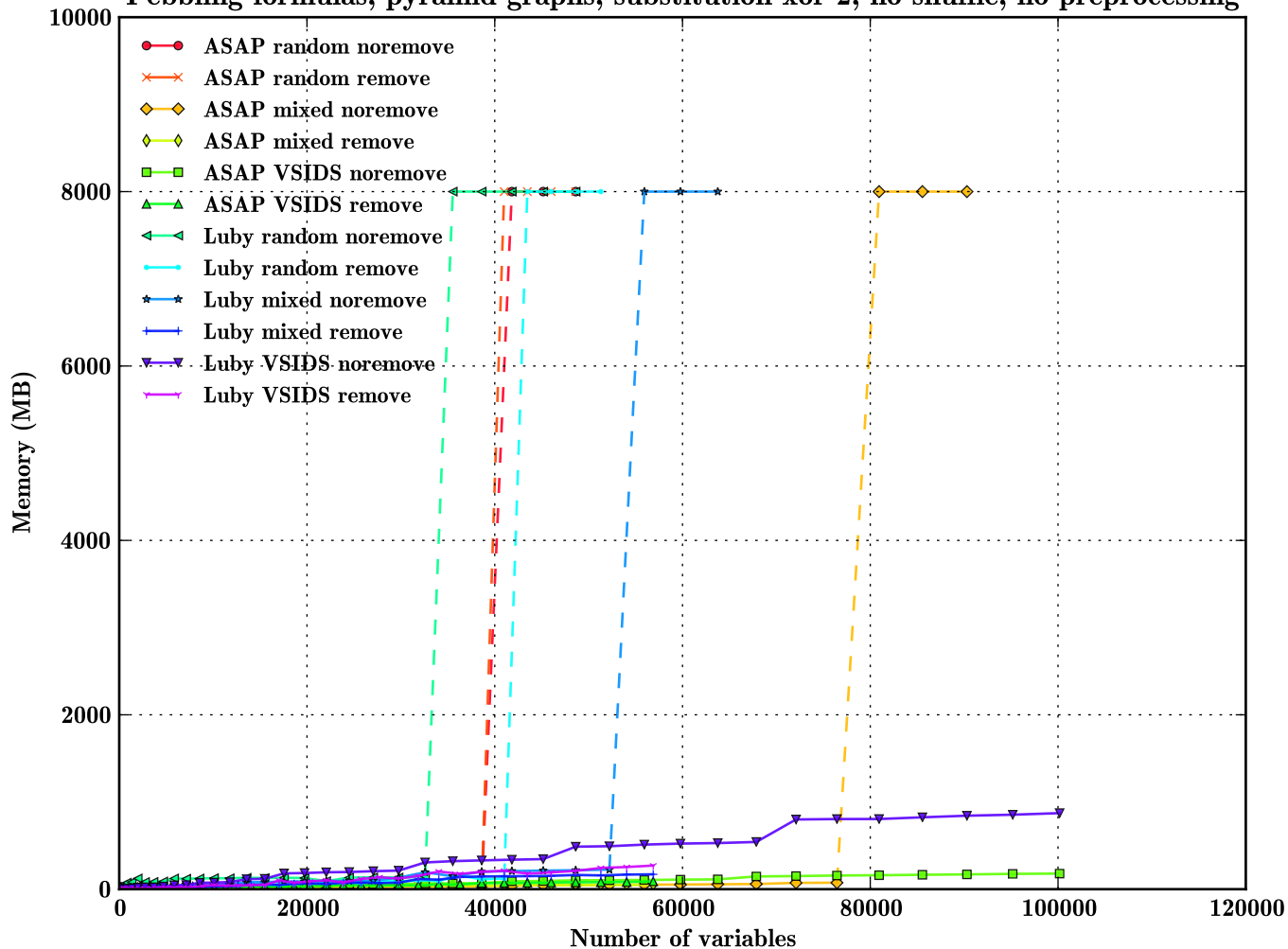
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, no shuffle, preprocessing



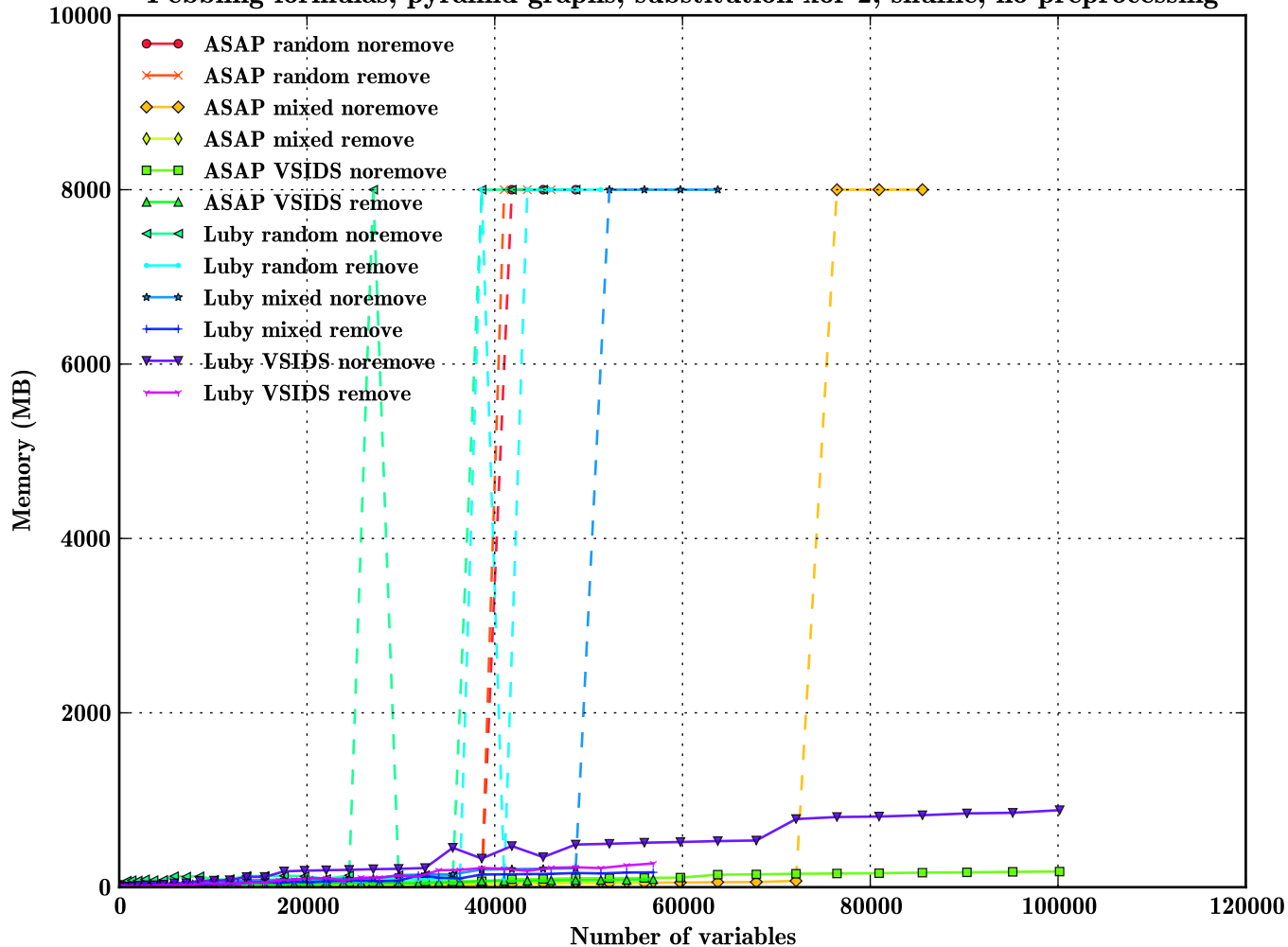
# Pebbling formulas, Gilbert-Tarjan graphs, substitution xor 2, shuffle, preprocessing



Pebbling formulas, pyramid graphs, substitution xor 2, no shuffle, no preprocessing



Pebbling formulas, pyramid graphs, substitution xor 2, shuffle, no preprocessing

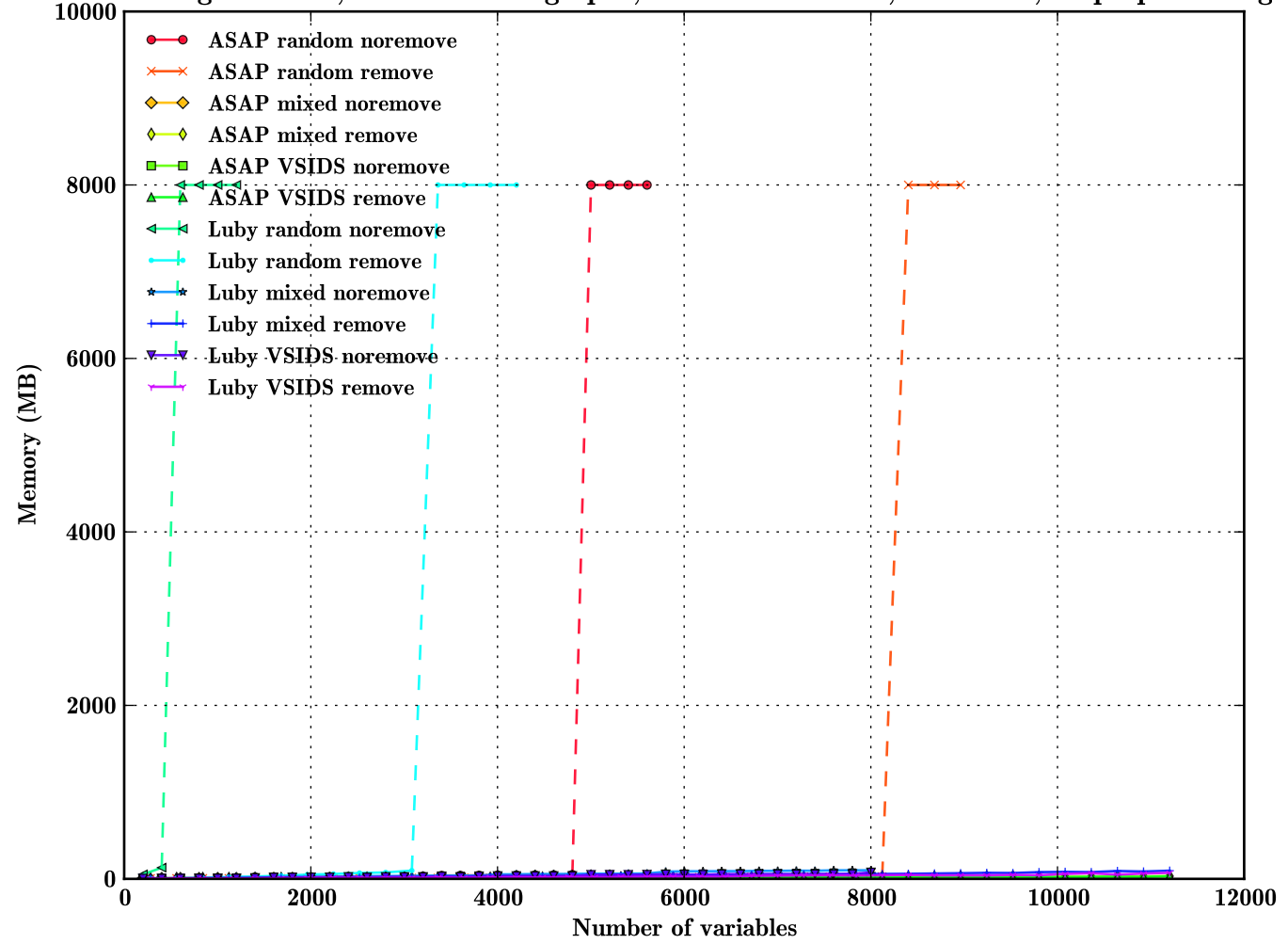






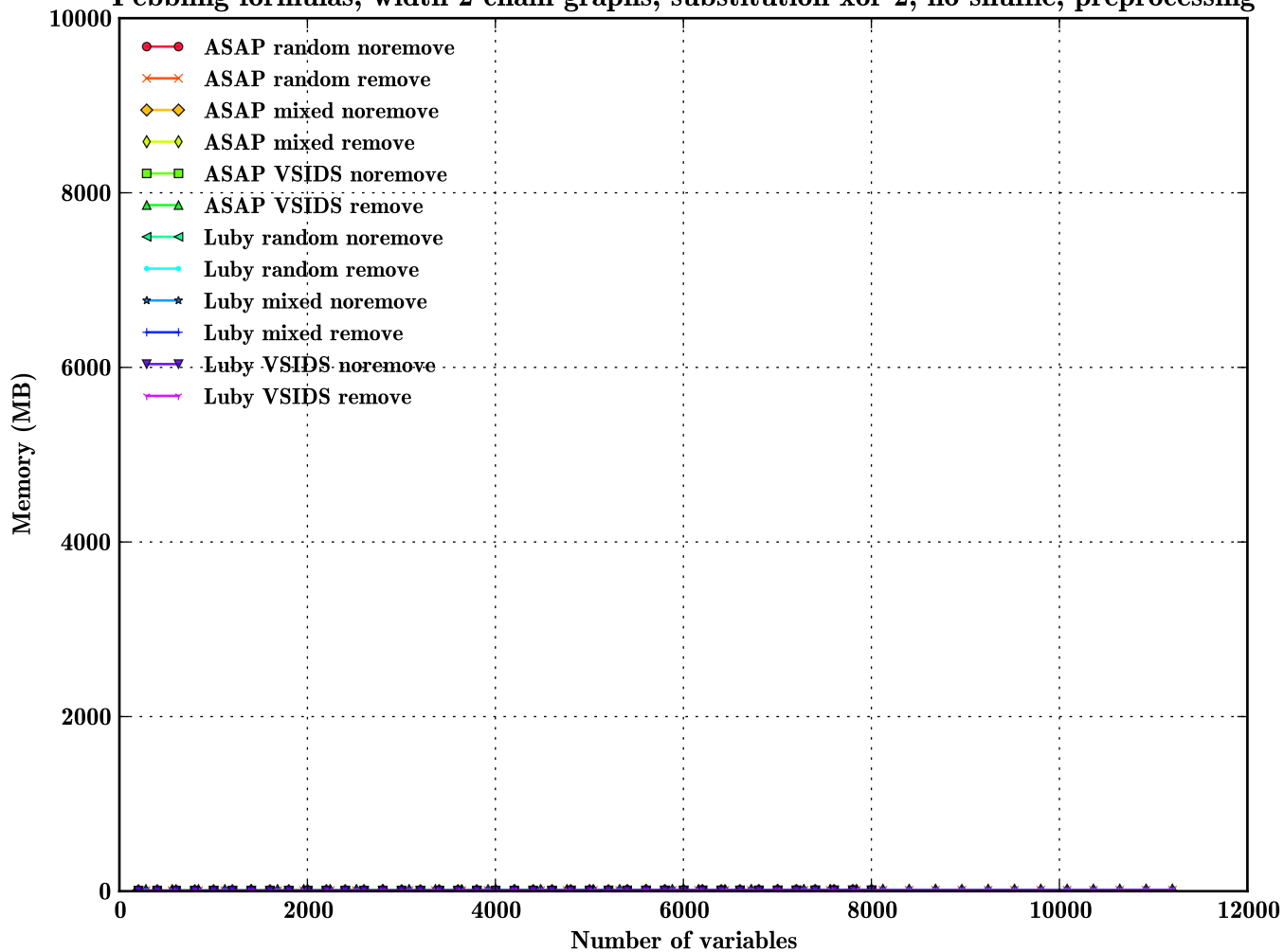


Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, no preprocessing





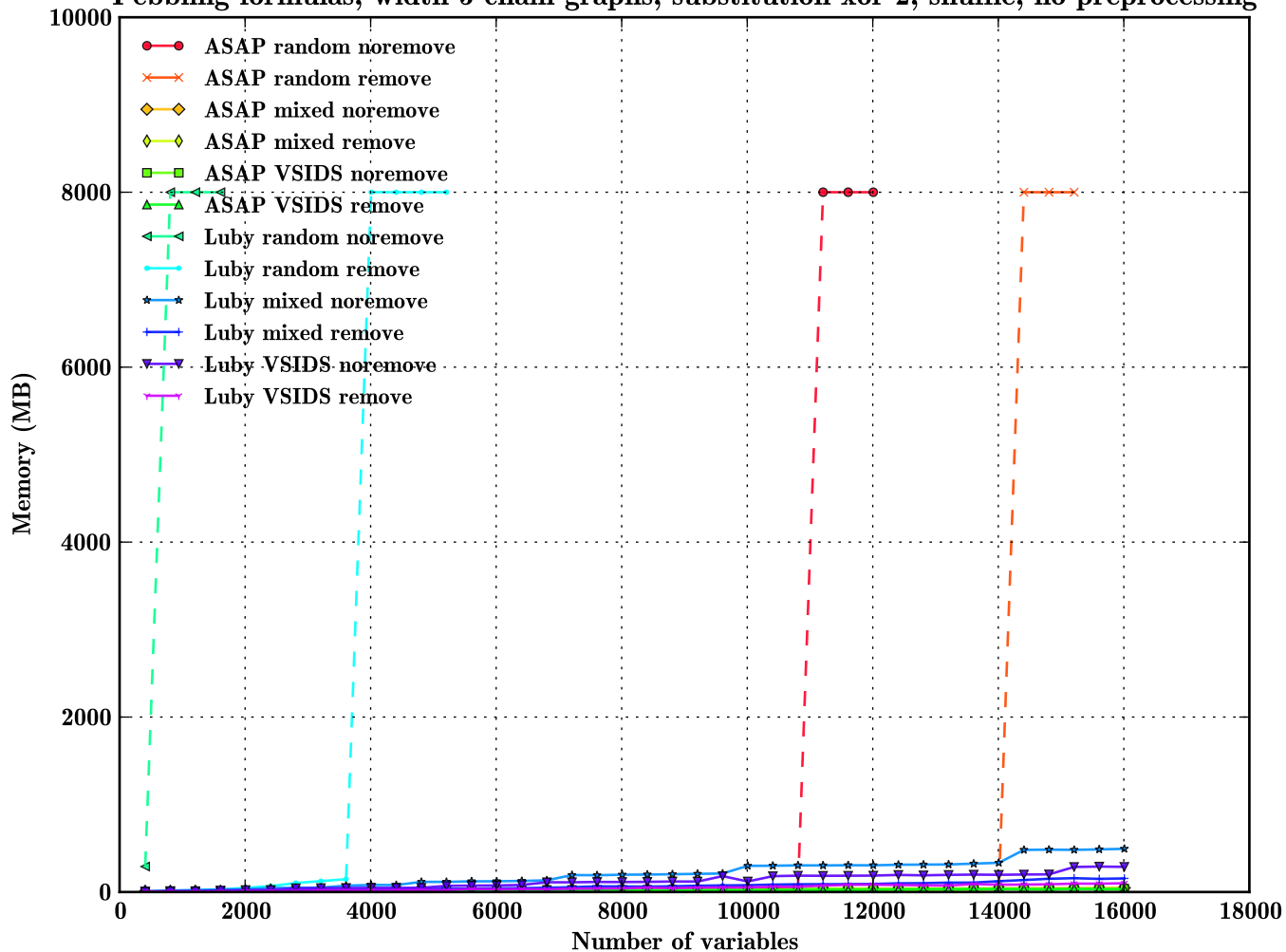
# Pebbling formulas, width 2 chain graphs, substitution xor 2, no shuffle, preprocessing





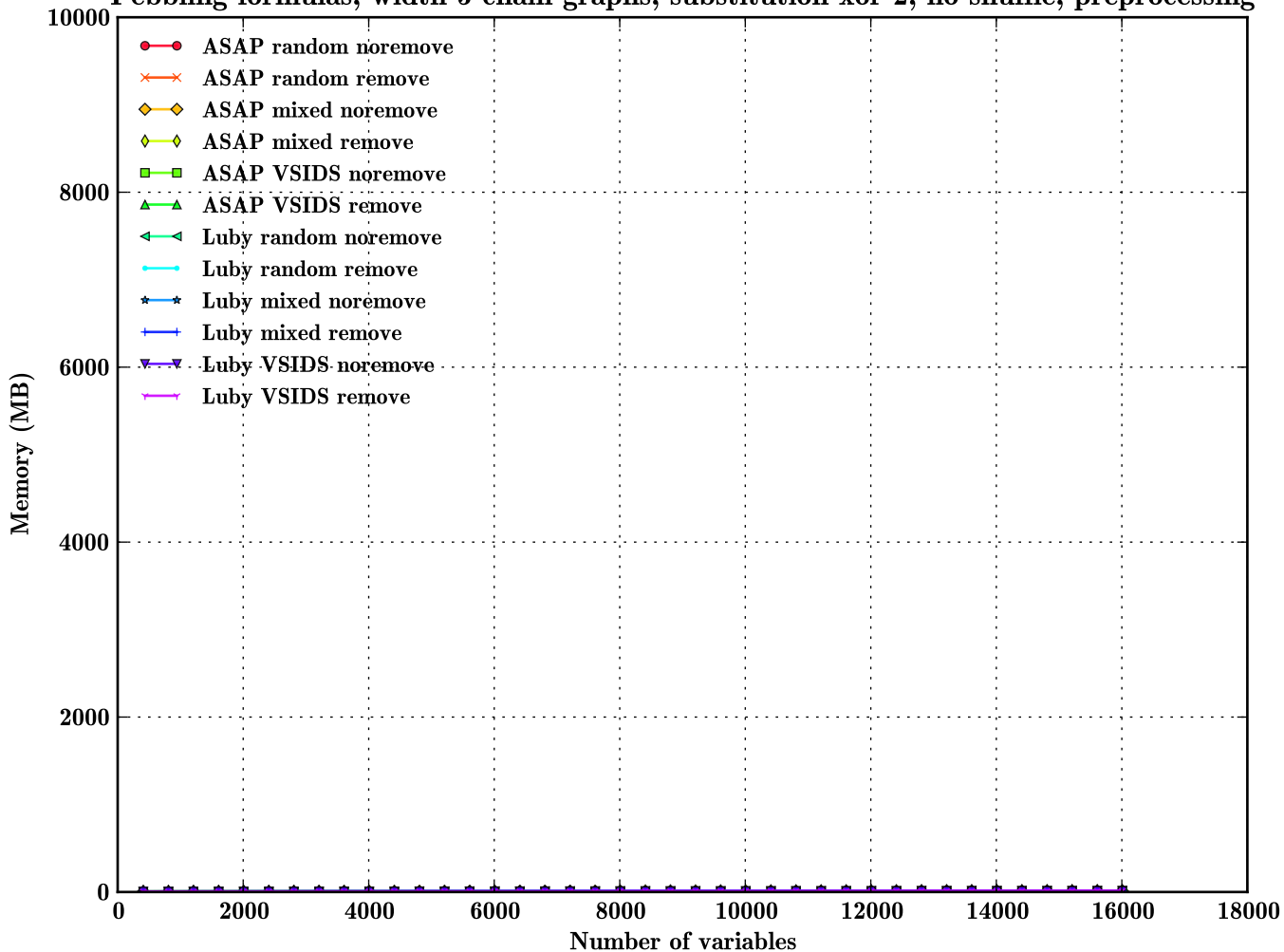


Pebbling formulas, width 5 chain graphs, substitution xor 2, shuffle, no preprocessing





Pebbling formulas, width 5 chain graphs, substitution xor 2, no shuffle, preprocessing





# Relativized pigeonhole principle formulas (RPHP)

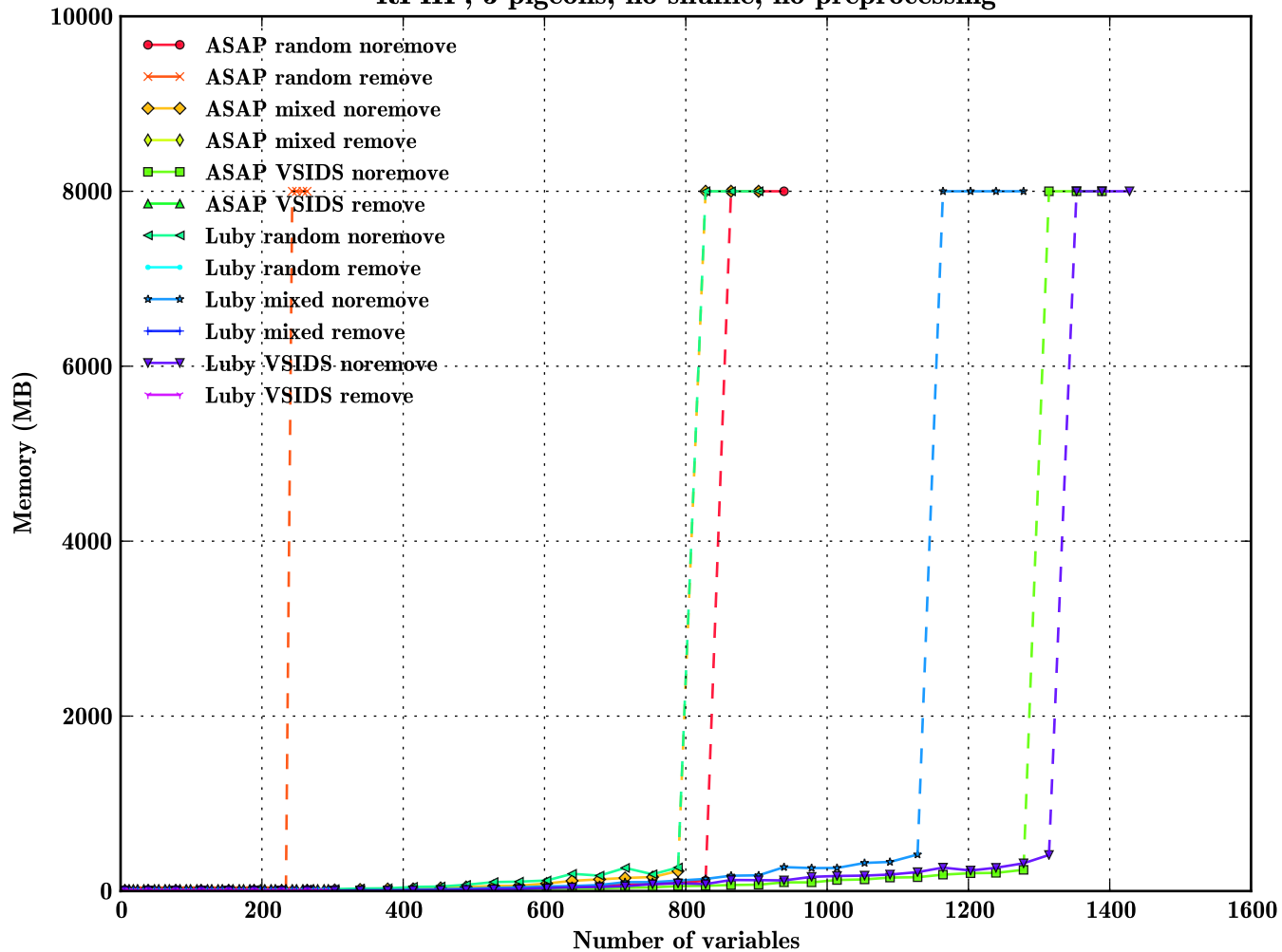






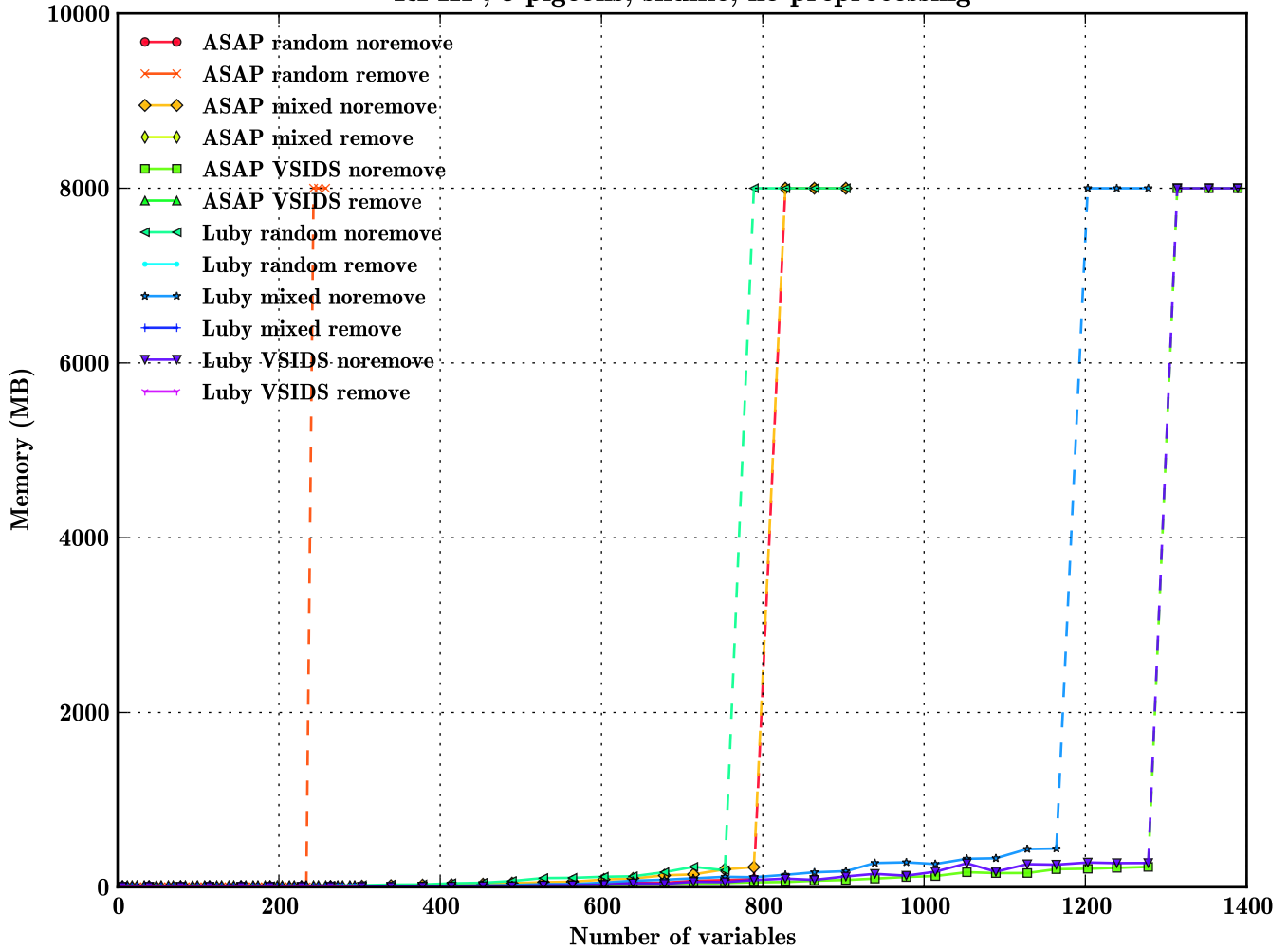


RPHP, 3 pigeons, no shuffle, no preprocessing

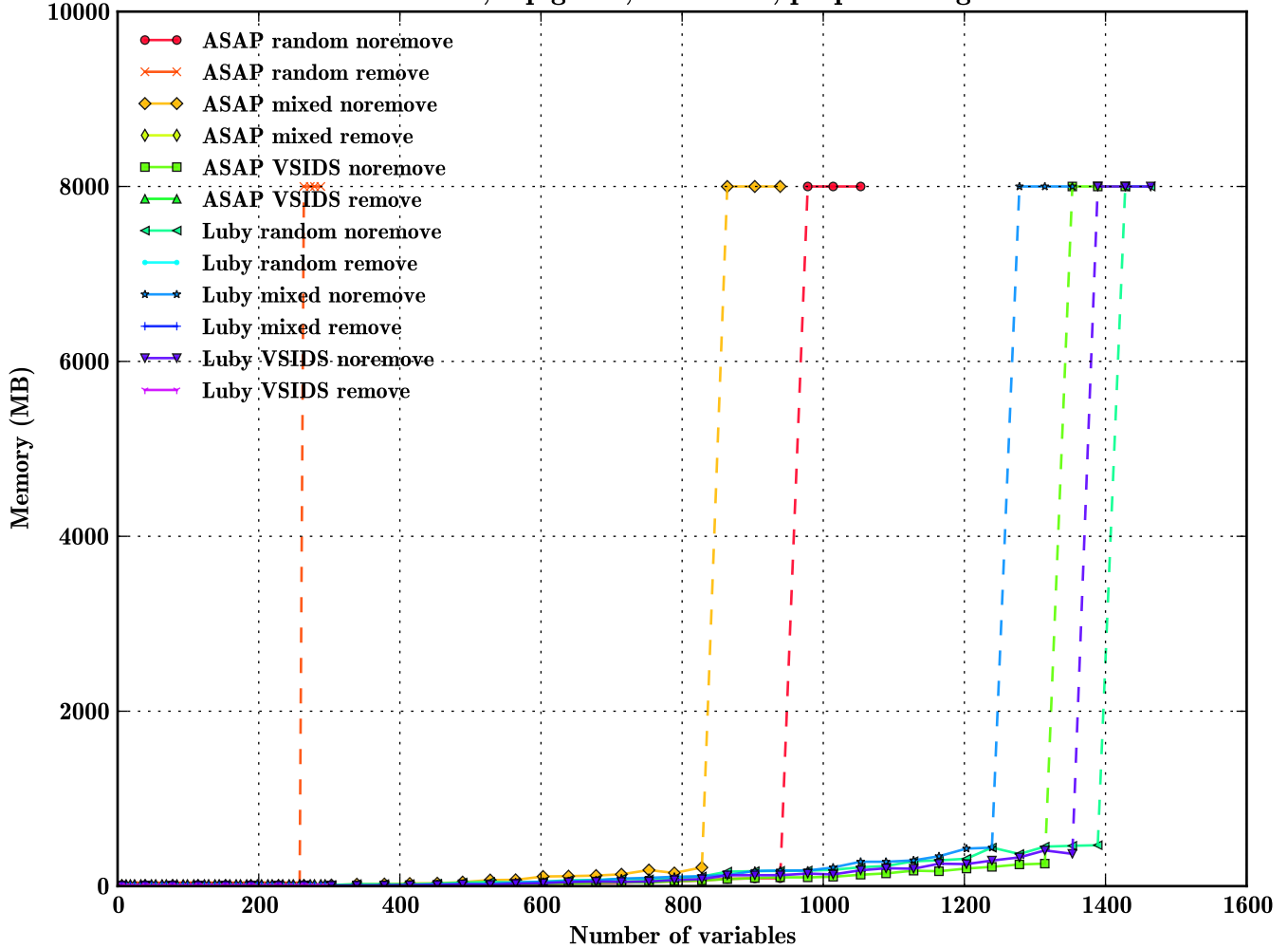




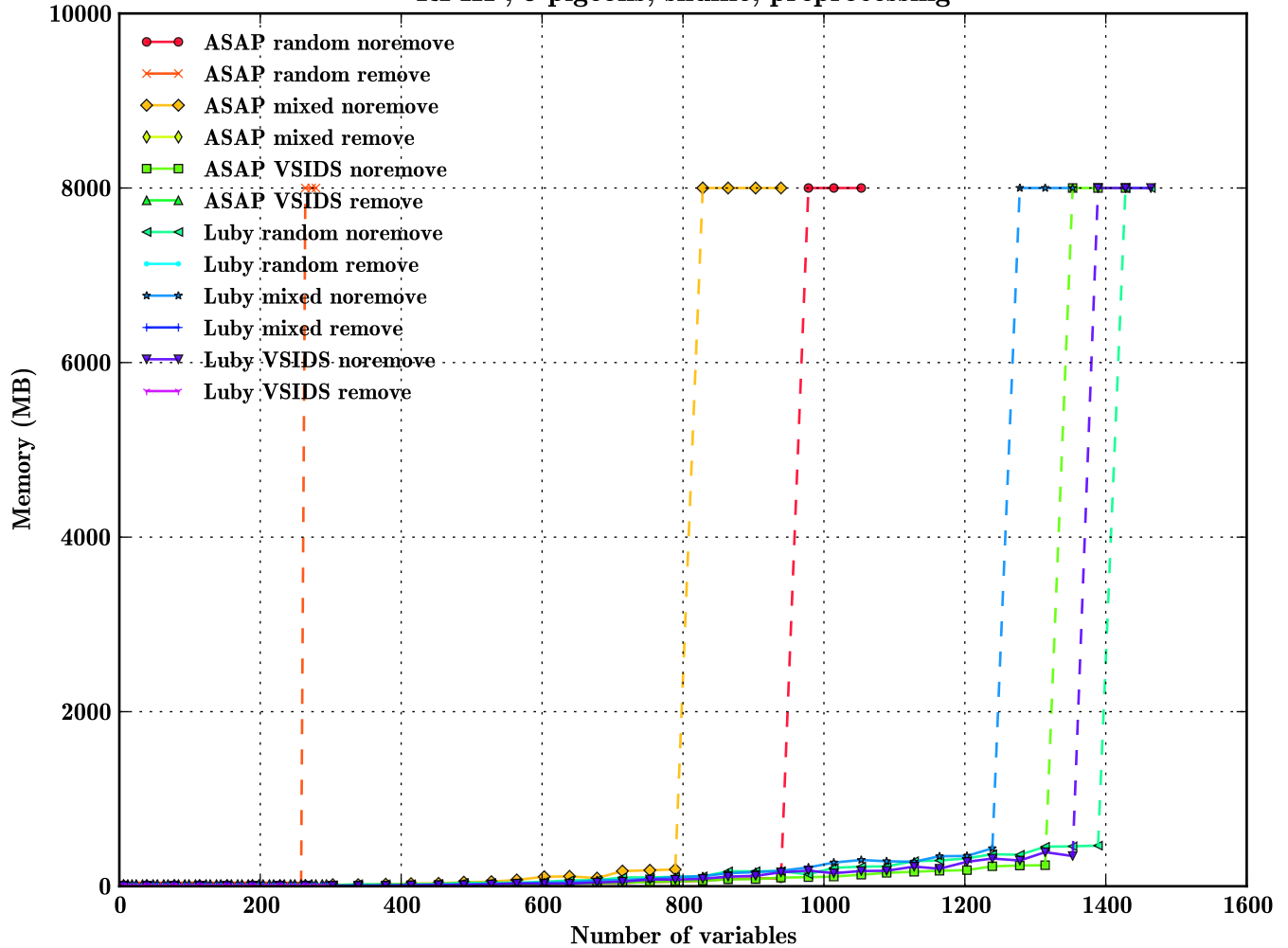
### RPHP, 3 pigeons, shuffle, no preprocessing



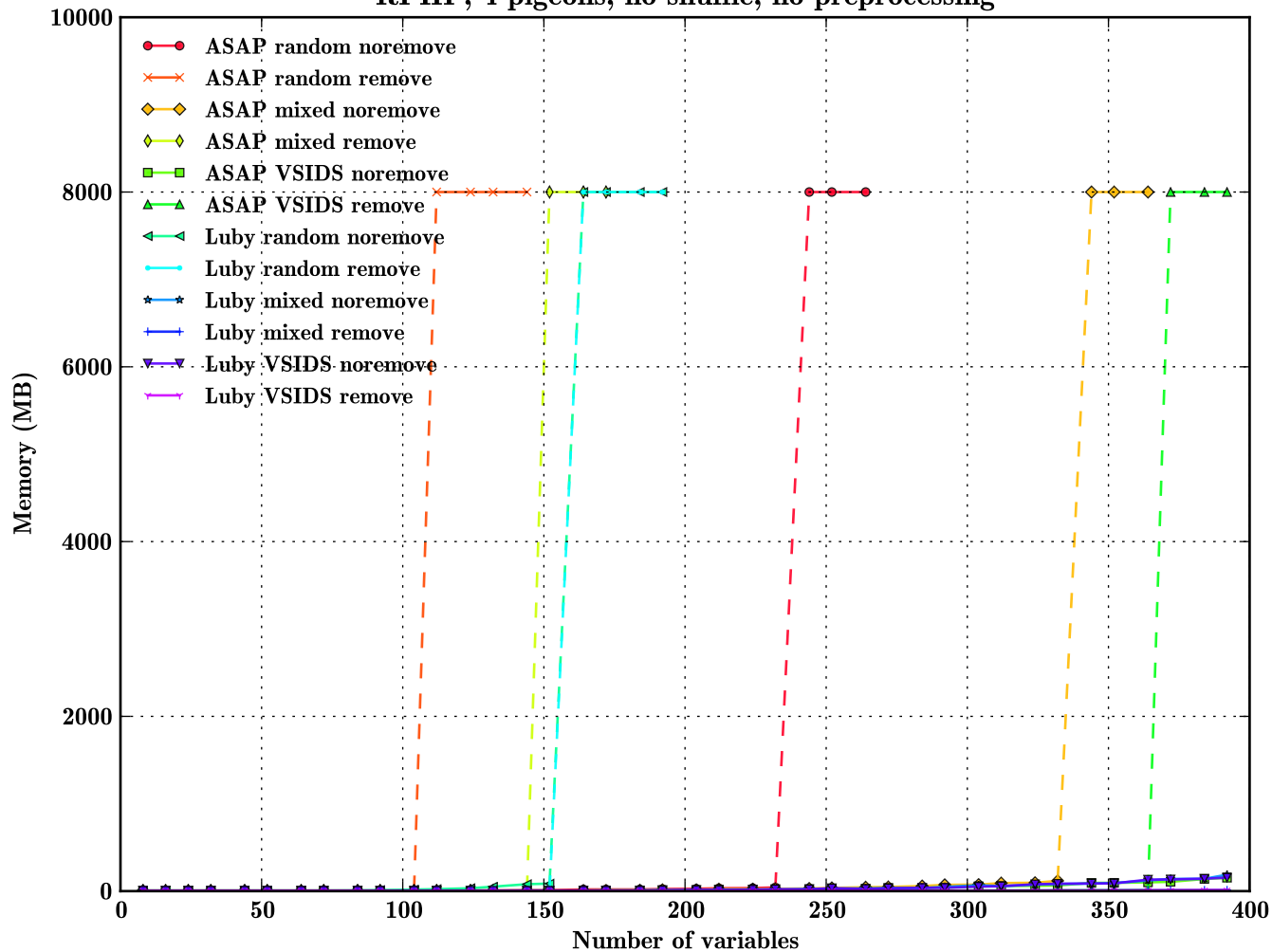
RPHP, 3 pigeons, no shuffle, preprocessing



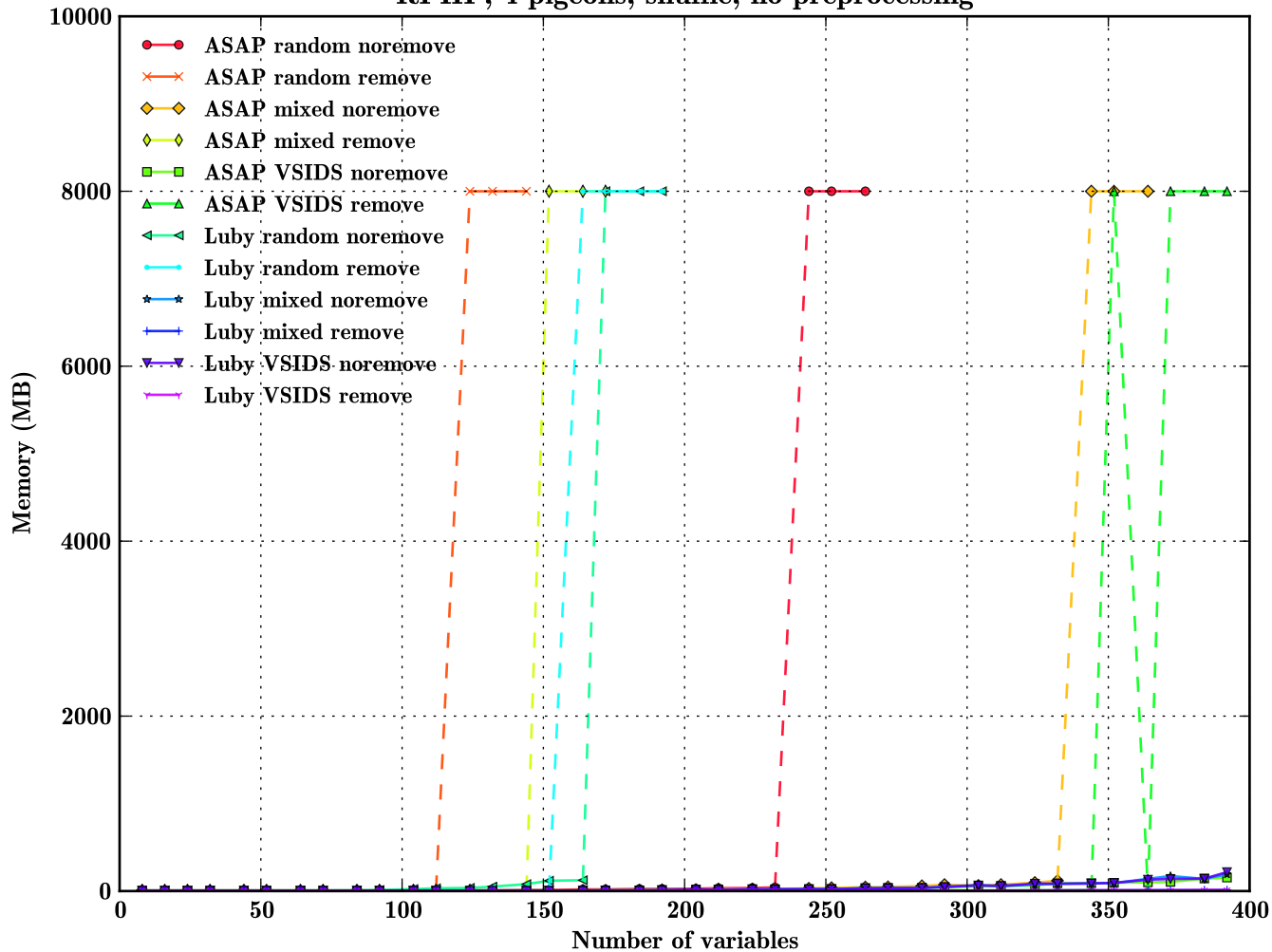
RPHP, 3 pigeons, shuffle, preprocessing



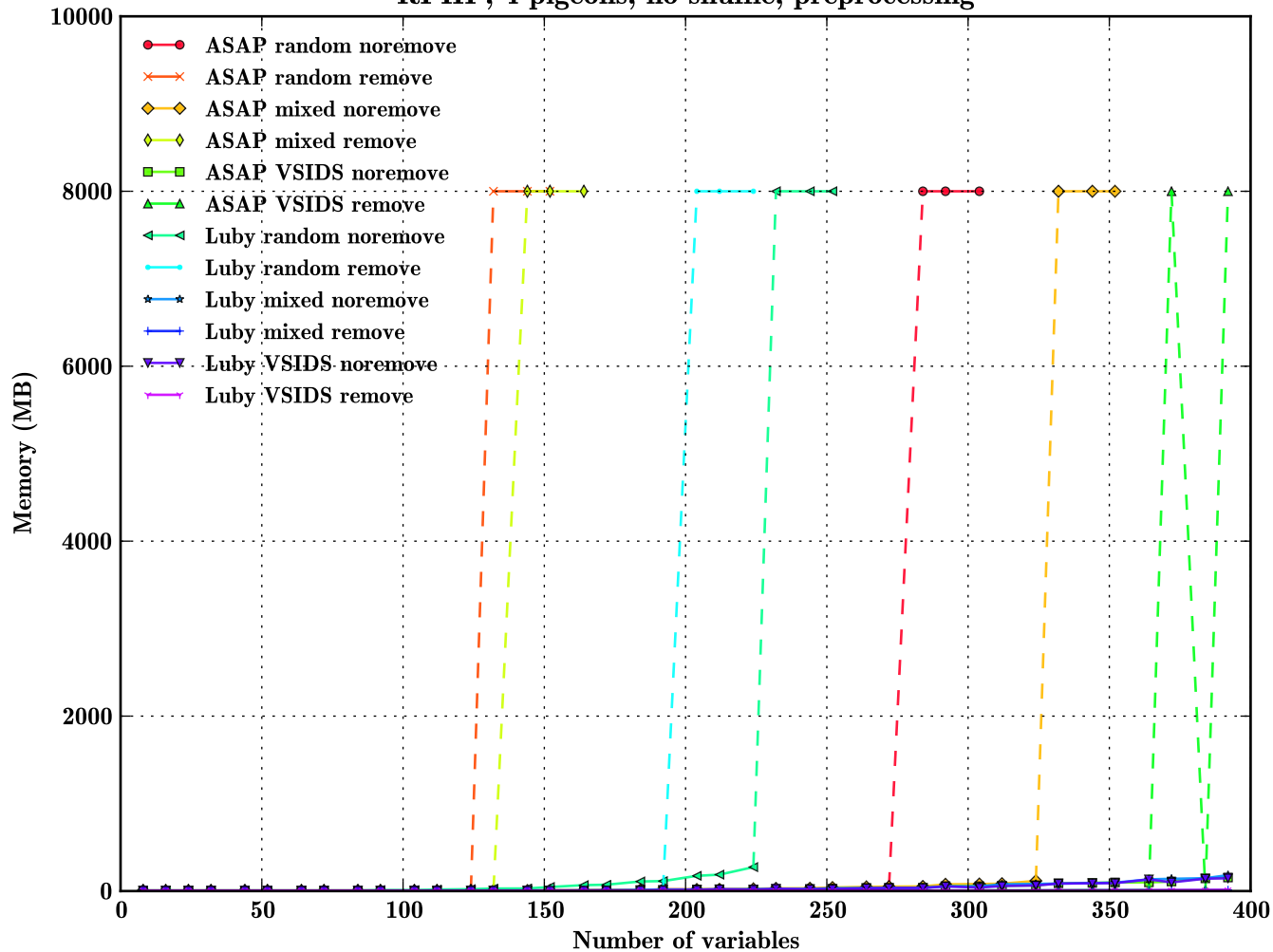
RPHP, 4 pigeons, no shuffle, no preprocessing



### RPHP, 4 pigeons, shuffle, no preprocessing

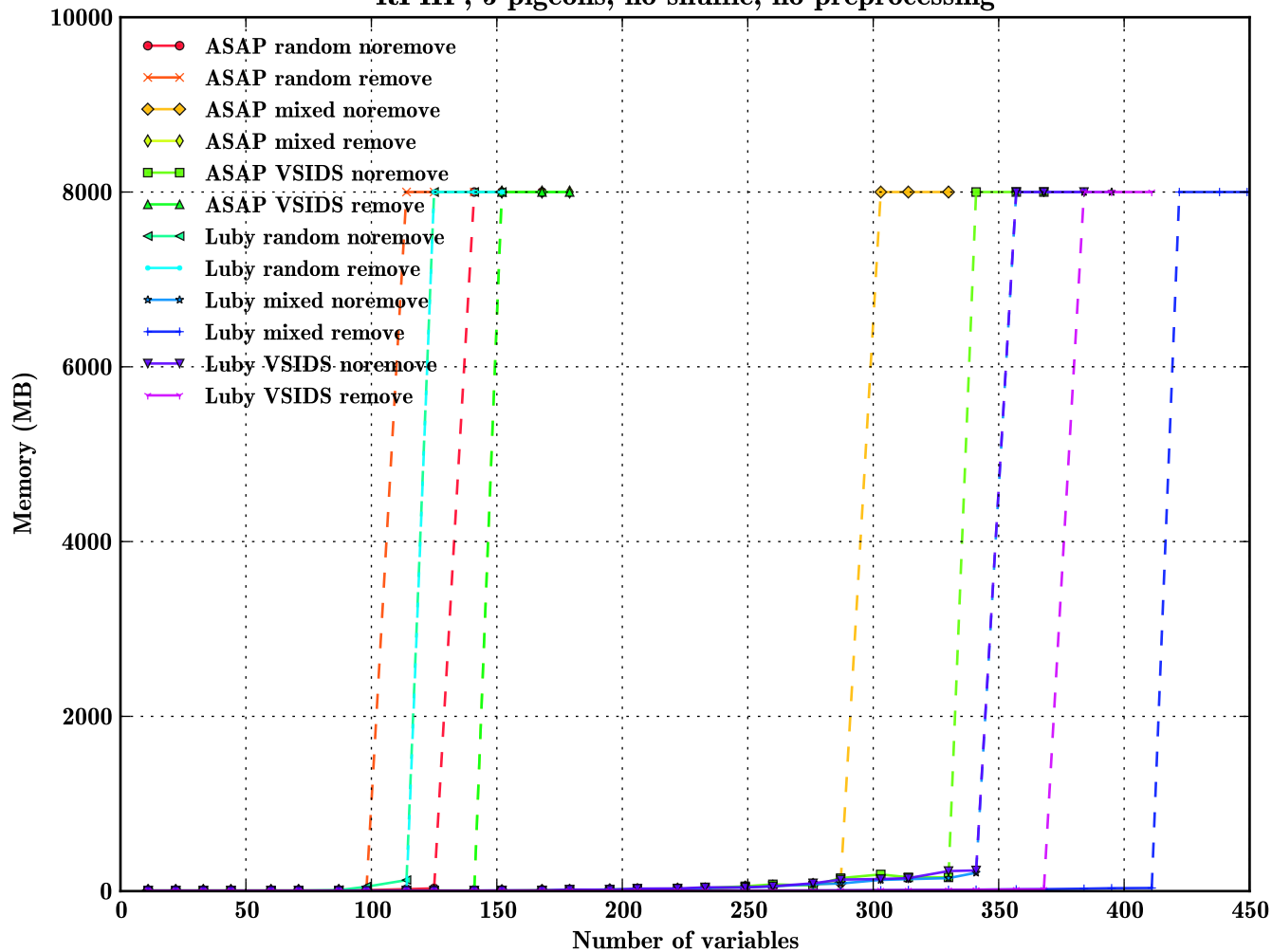


### RPHP, 4 pigeons, no shuffle, preprocessing



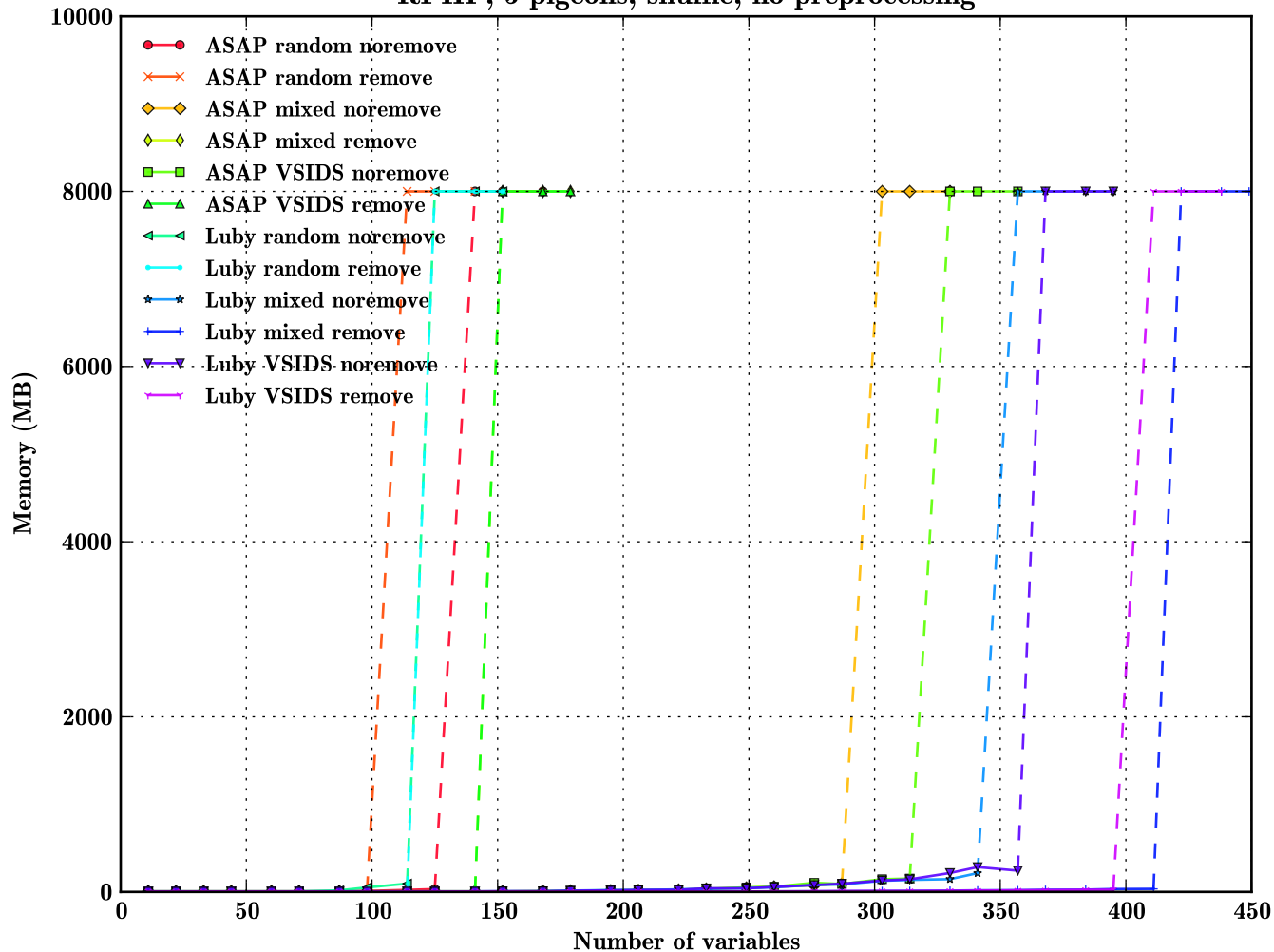


RPHP, 5 pigeons, no shuffle, no preprocessing



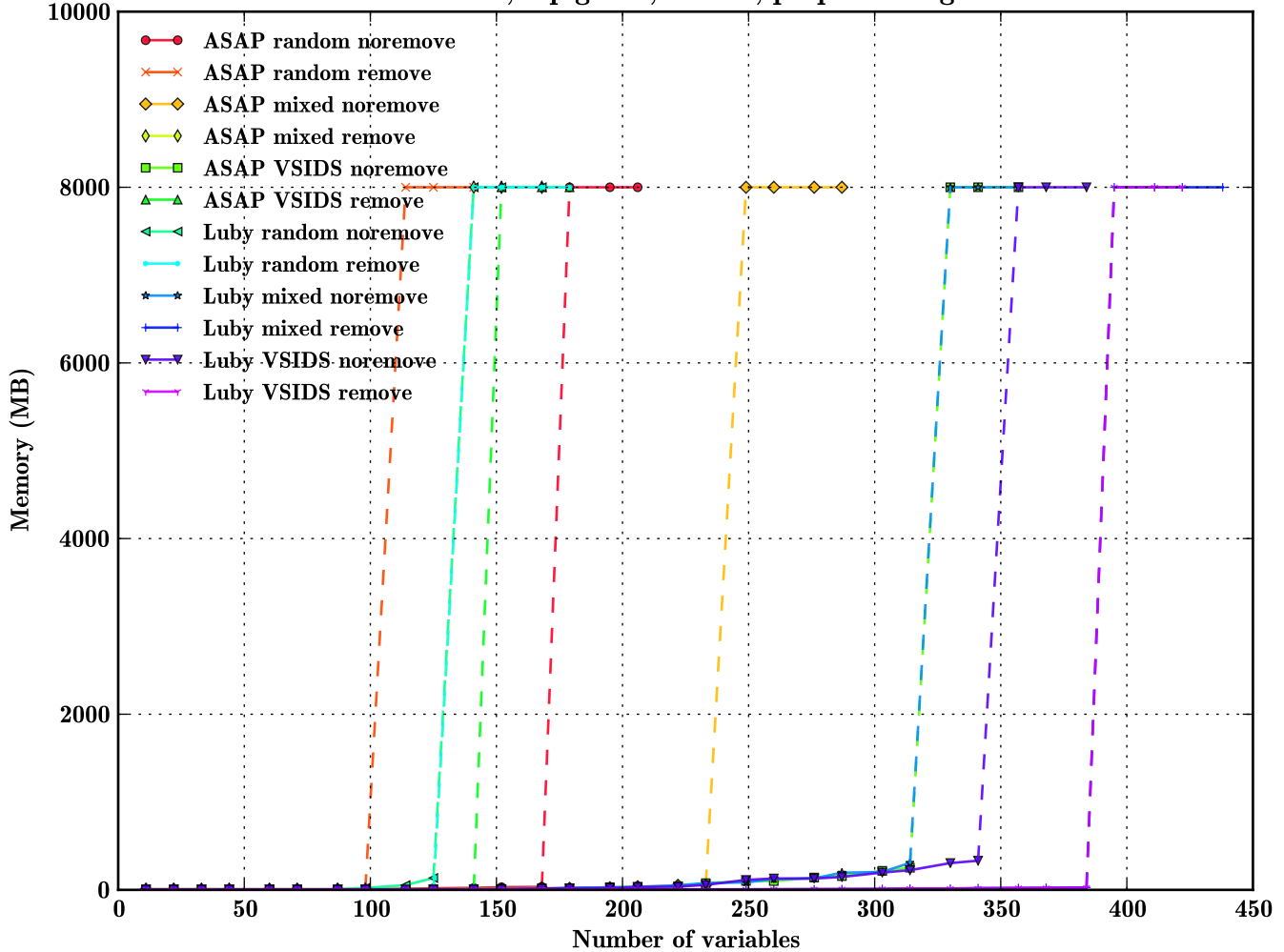


RPHP, 5 pigeons, shuffle, no preprocessing



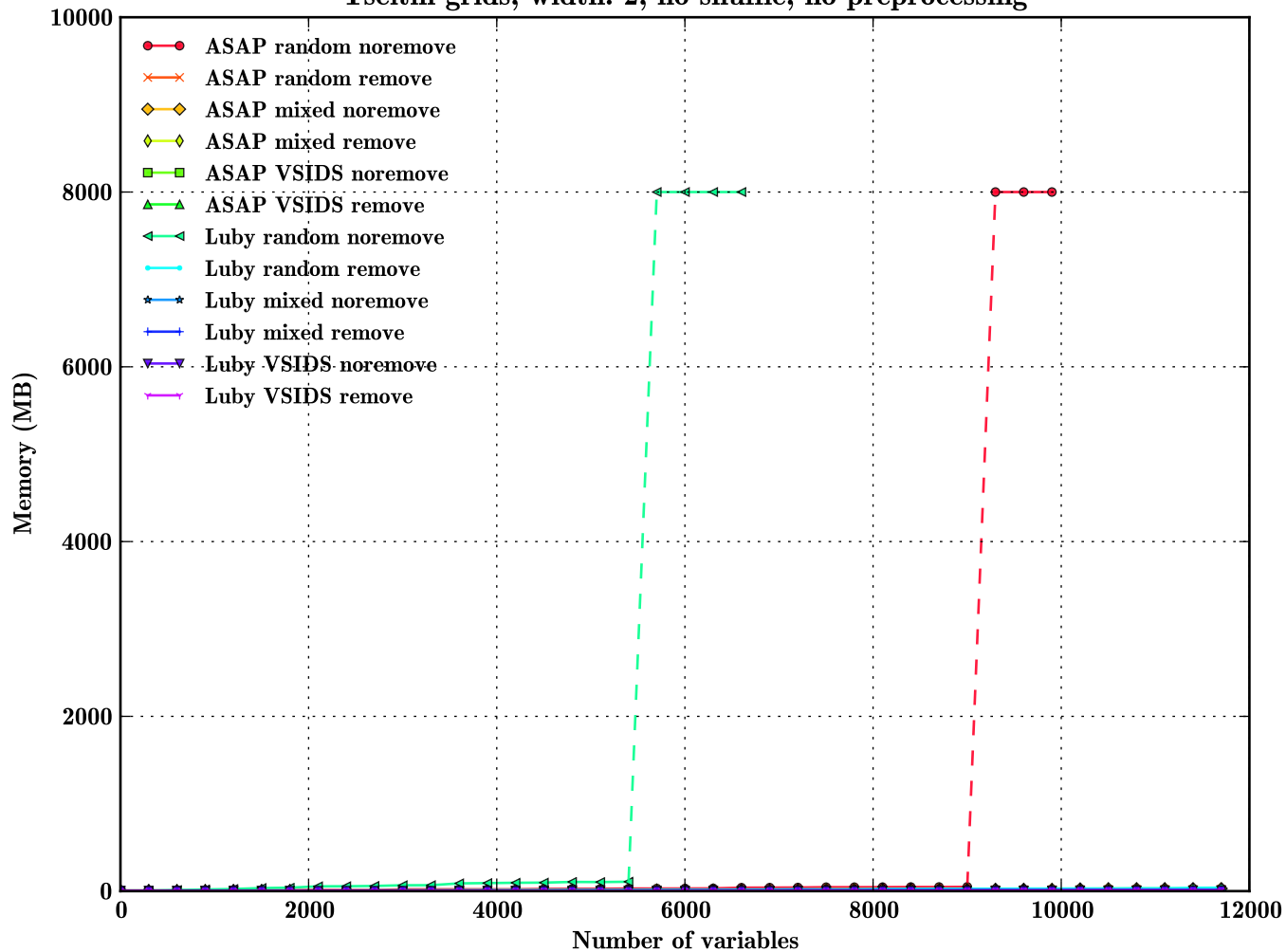


RPHP, 5 pigeons, shuffle, preprocessing

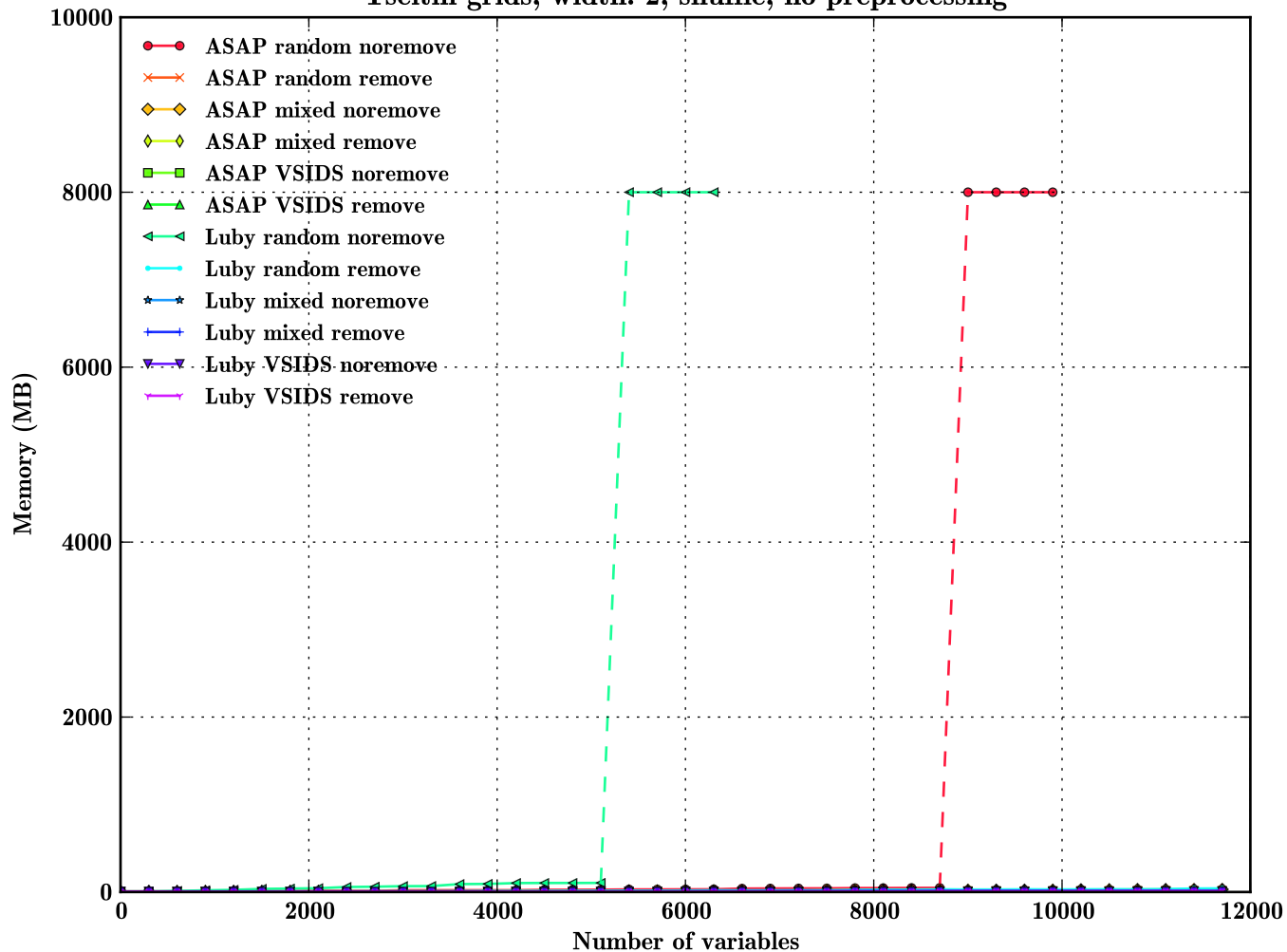


# Tseitin grids

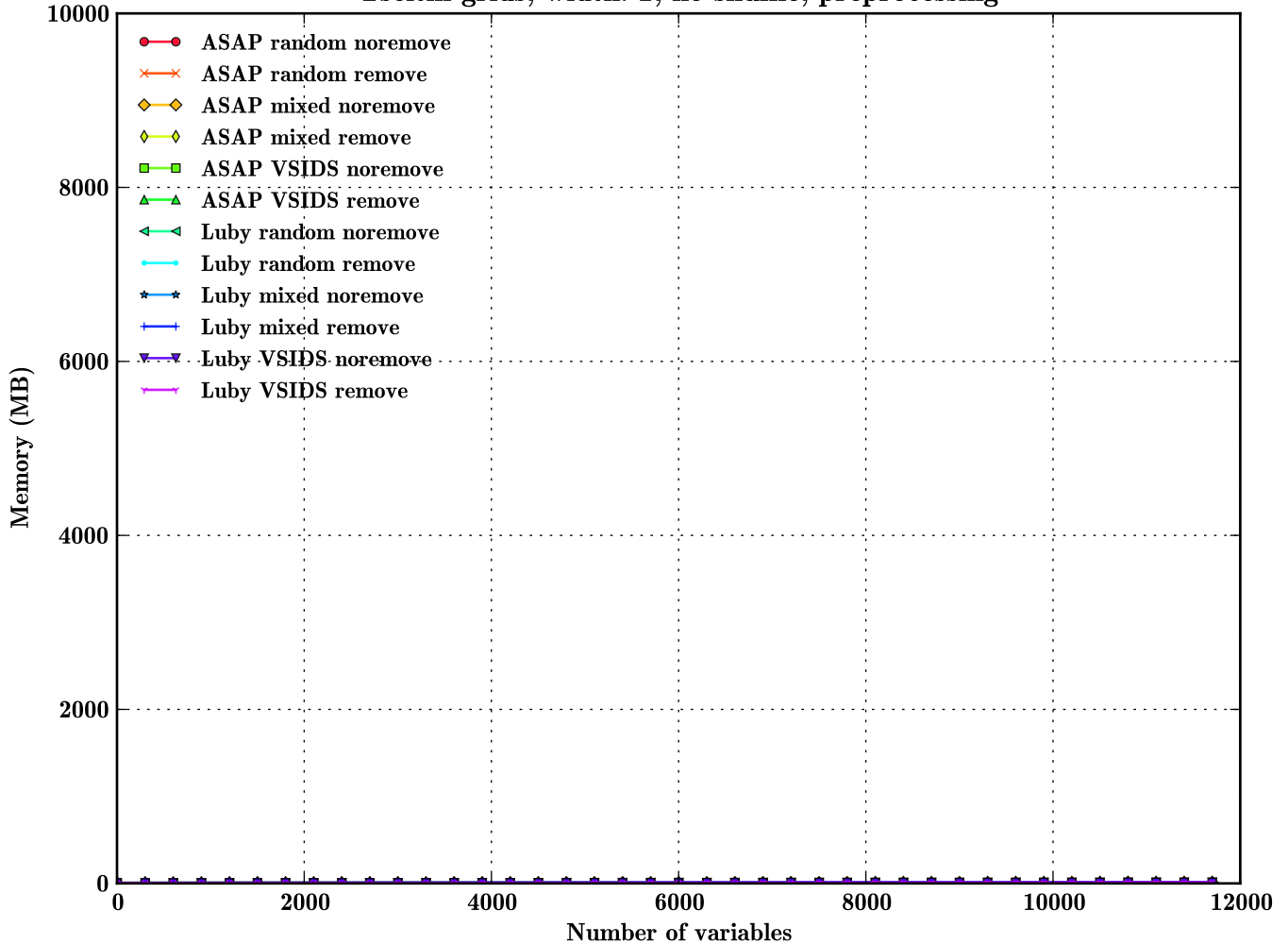
Tseitin grids, width: 2, no shuffle, no preprocessing



Tseitlin grids, width: 2, shuffle, no preprocessing



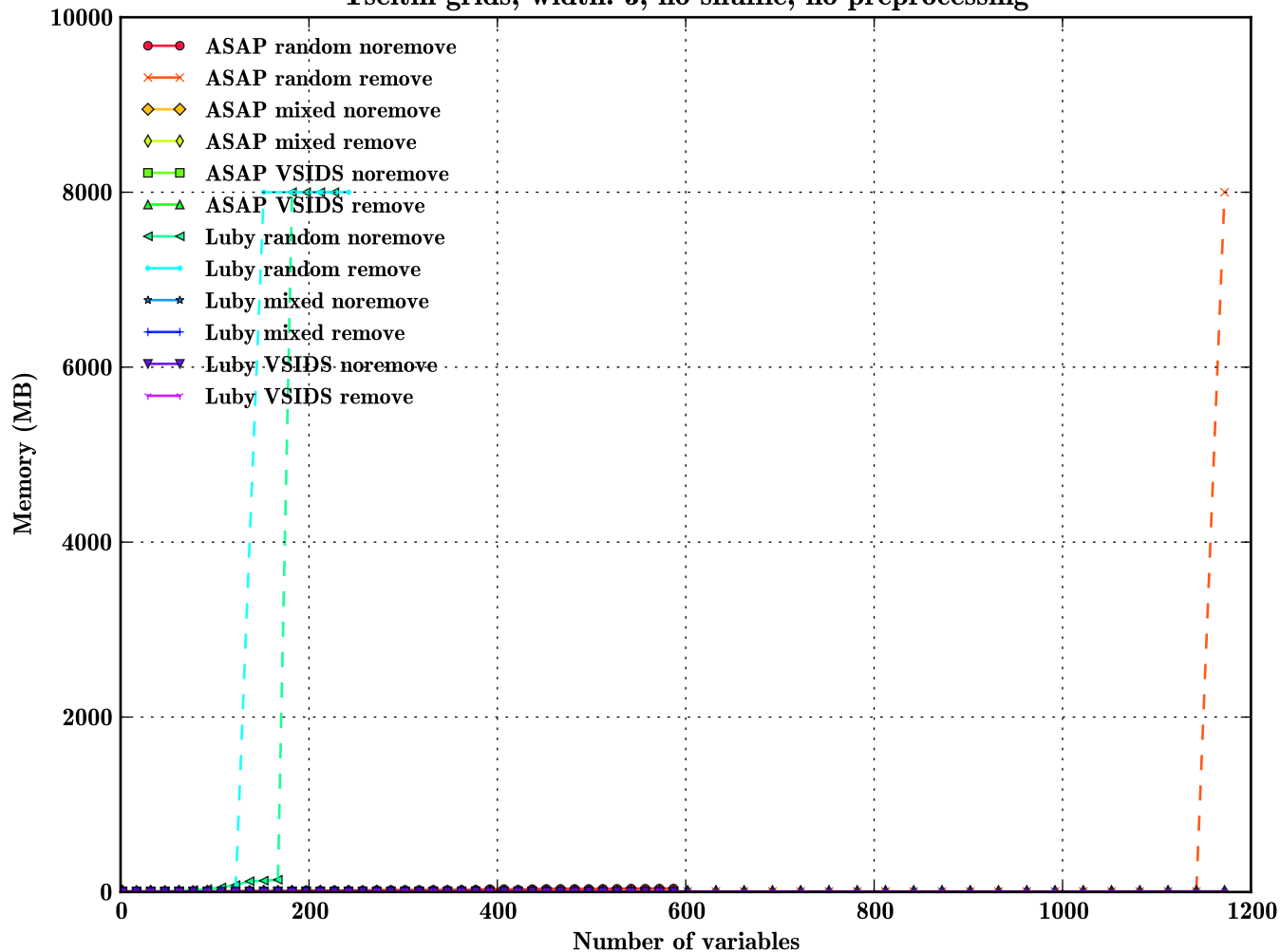
Tseitlin grids, width: 2, no shuffle, preprocessing







Tseitin grids, width: 3, no shuffle, no preprocessing



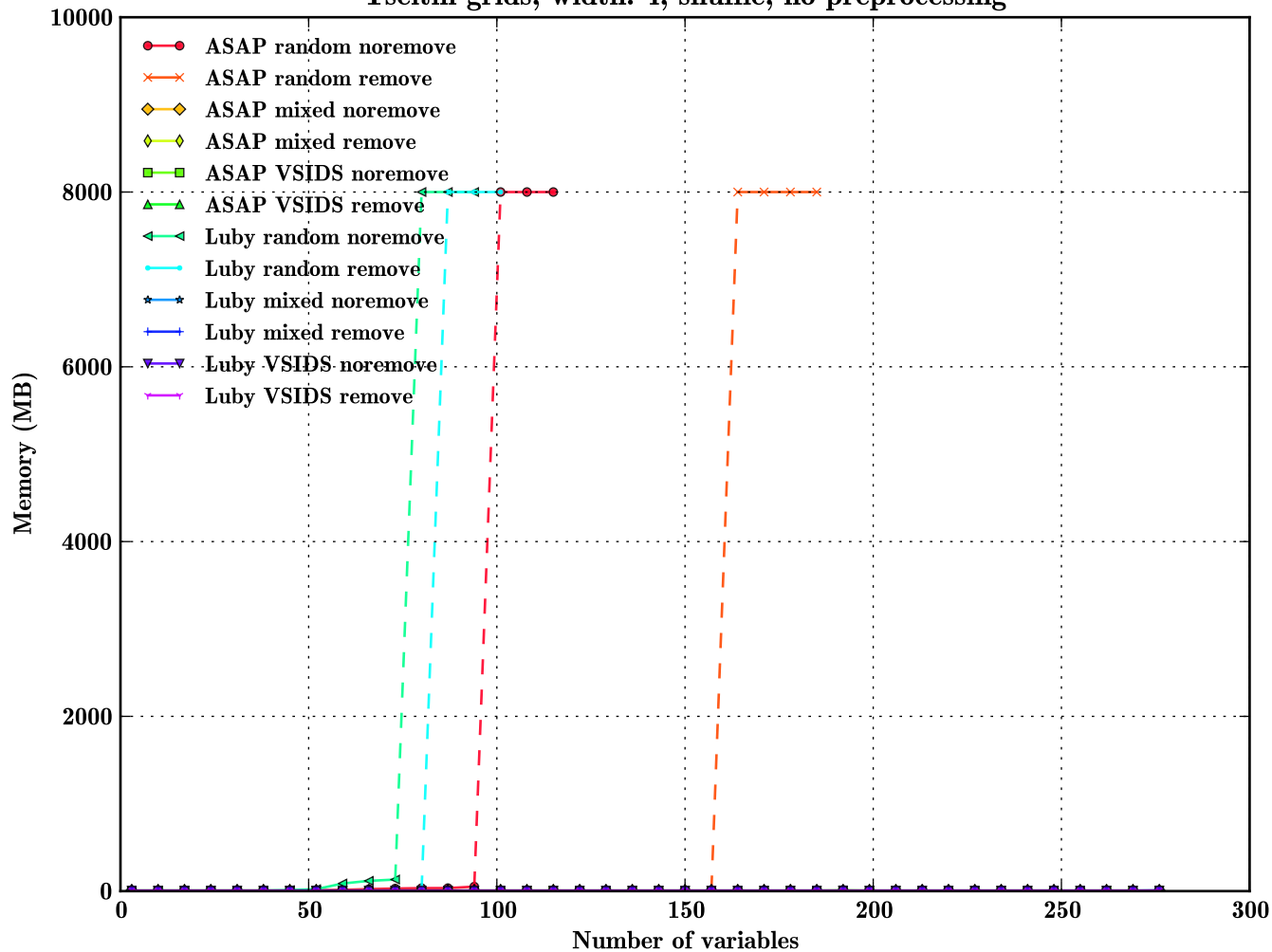




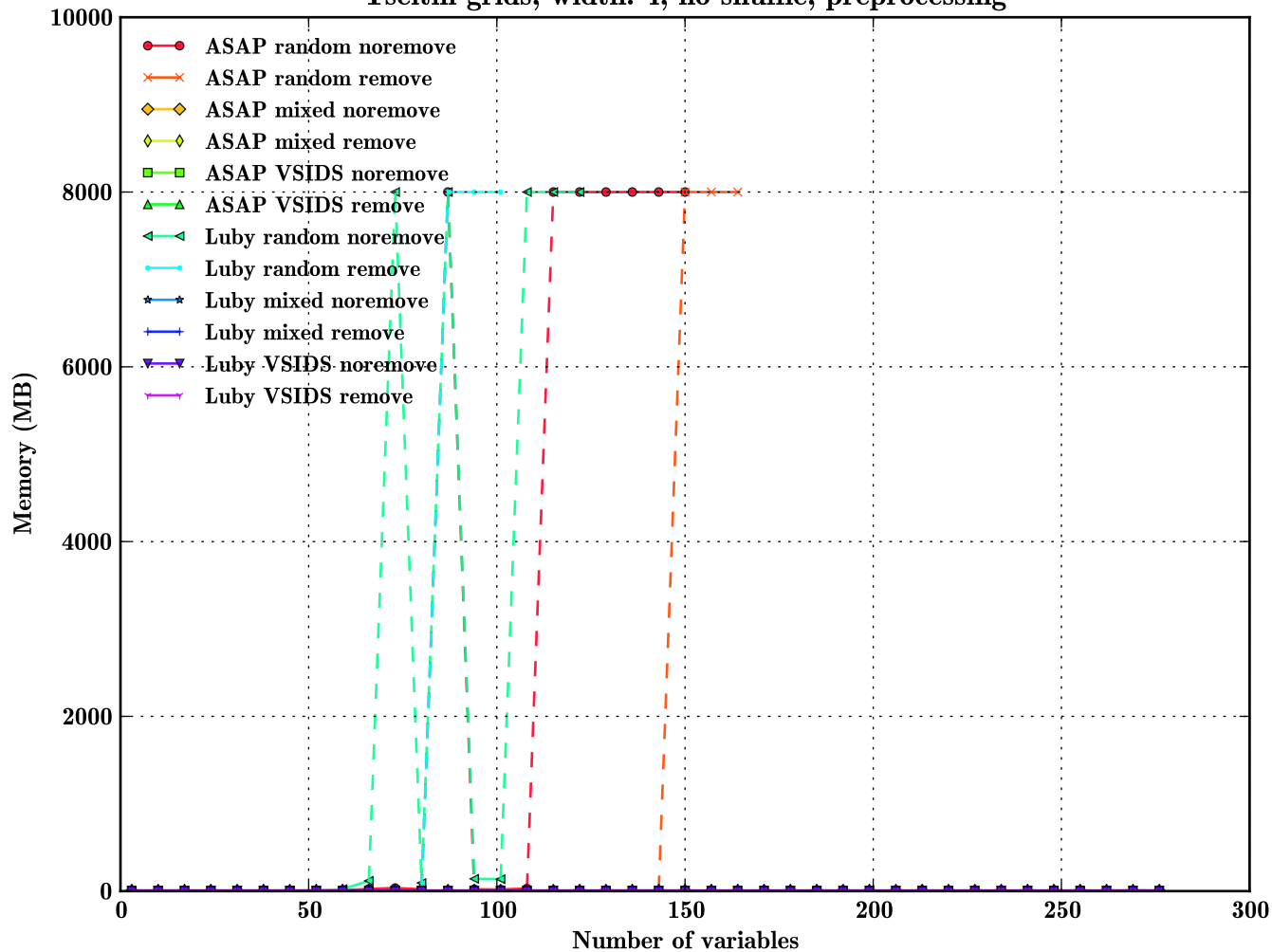




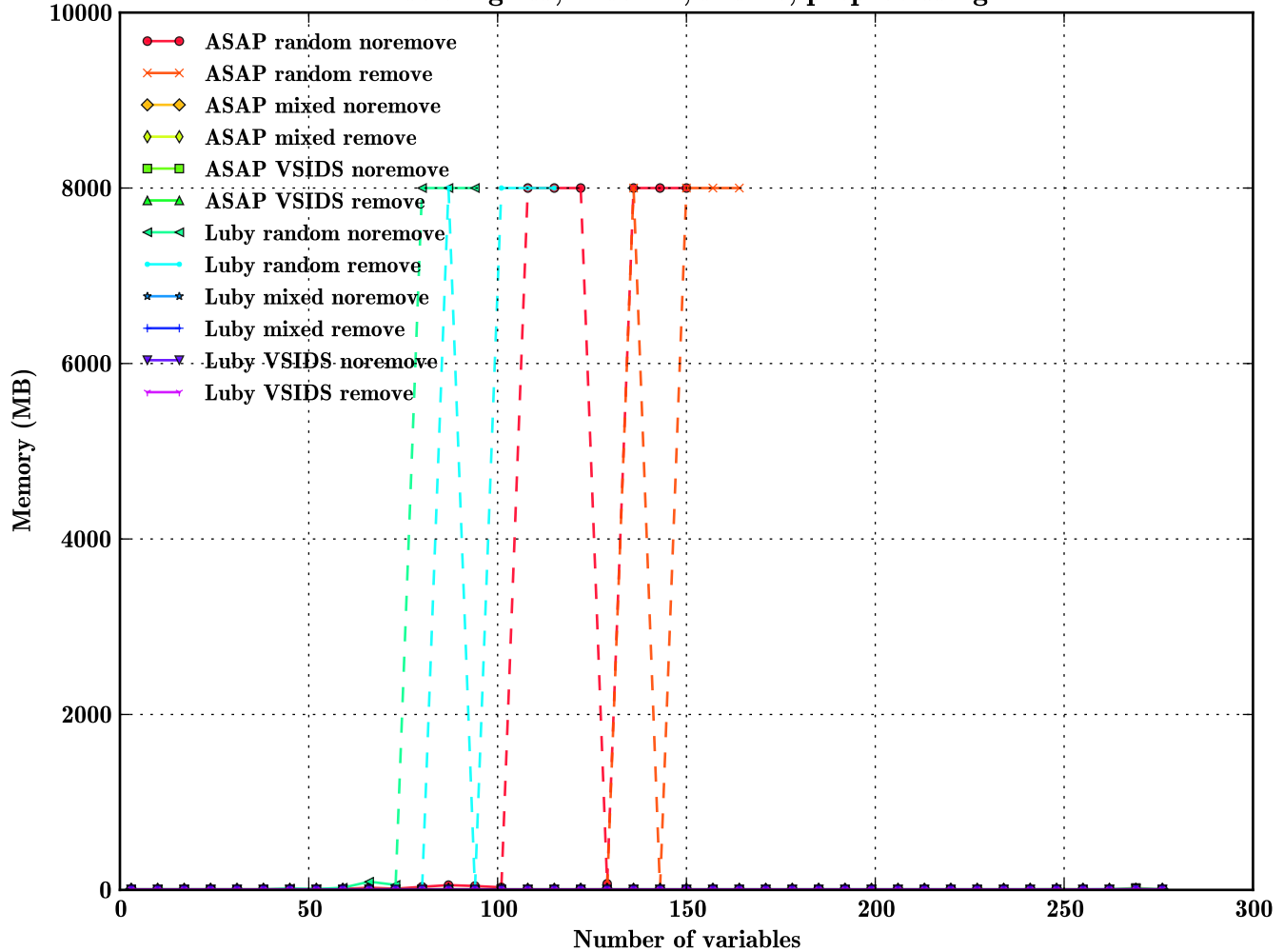
Tseitin grids, width: 4, shuffle, no preprocessing



Tseitin grids, width: 4, no shuffle, preprocessing

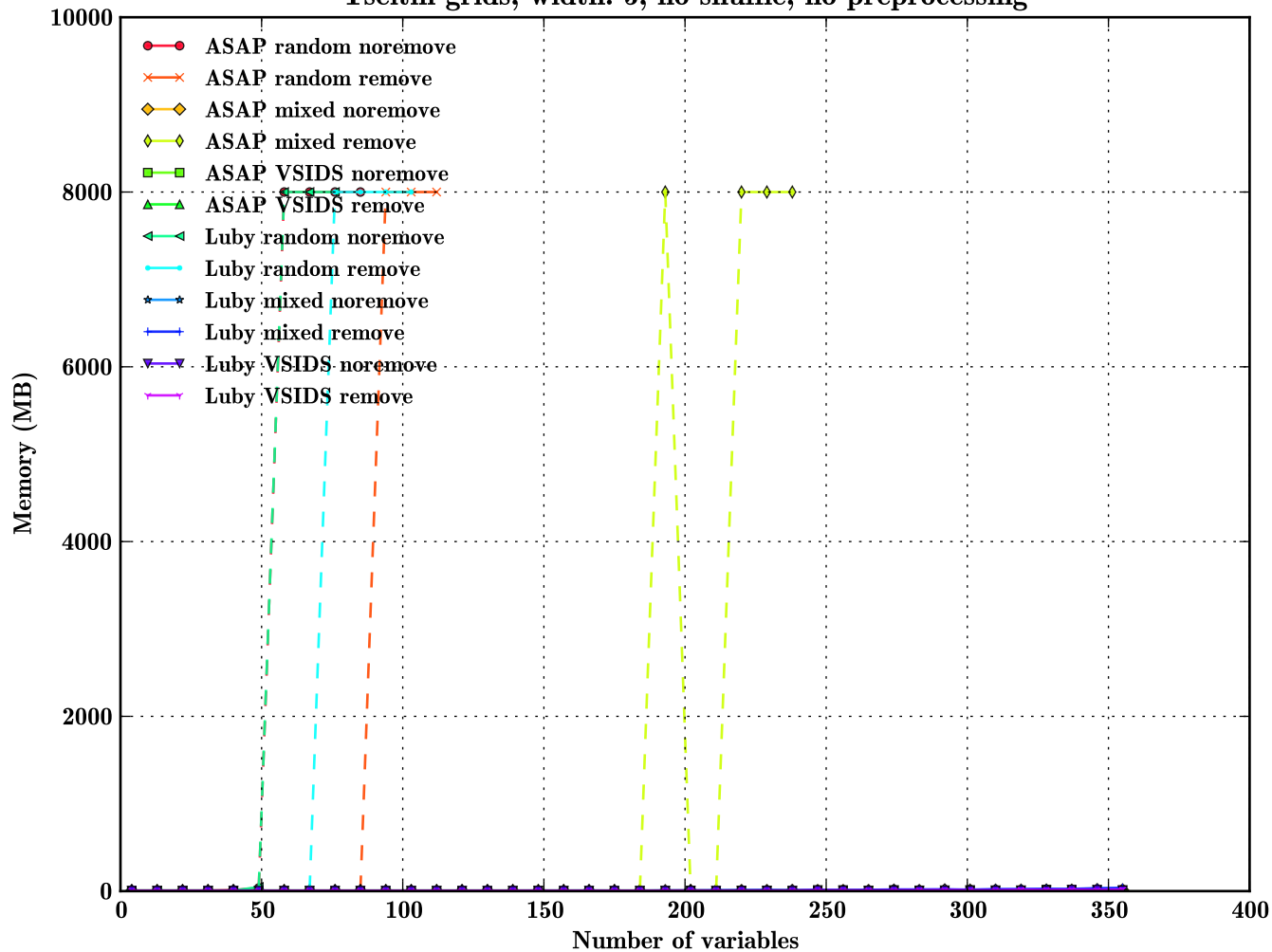


Tseitin grids, width: 4, shuffle, preprocessing

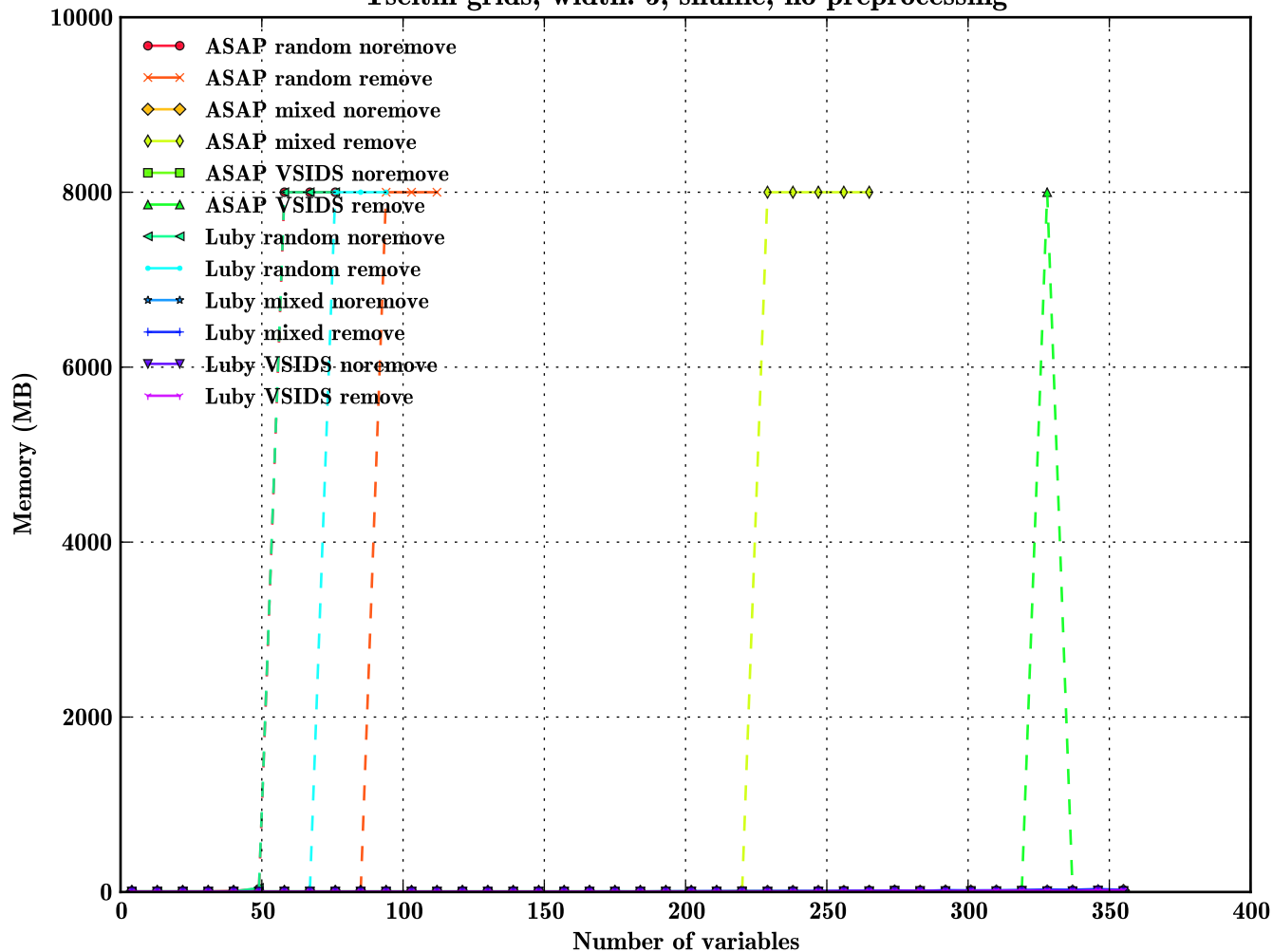




Tseitin grids, width: 5, no shuffle, no preprocessing



Tseitin grids, width: 5, shuffle, no preprocessing





Tseitin grids, width: 5, shuffle, preprocessing

