Wheeler graphs, part 2

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BW order

Nodes can be thought of according to what comes after (outgoing edges) and or just before (incoming)

Incoming edges spell out BWT
Outgoing paths spell out suffixes/rotations
BW order

Does our way of thinking about nodes still hold?
BW order

Does our way of thinking about nodes still hold?

No
BW order

Does our way of thinking about nodes still hold?

No

Nodes can have multiple predecessors
BW order

Does our way of thinking about nodes still hold?

No

Nodes can have multiple predecessors

Nodes can have multiple suffixes leading out from them
BW order

Does our way of thinking about nodes still hold?

No

Nodes can have multiple predecessors

Nodes can have multiple suffixes leading out from them

Can we salvage BW order?
BW order

Might there still be a total order over outgoing suffixes, even when there’s >1 per node?
BW order

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BW order

Might there still be a total order over outgoing suffixes, even when there’s >1 per node?

{gattacat$,
gattagat$}
{attacat$,
atttagat$}
{ttacat$,
ttagat$}
{tacat$,
tagat$}
{acat$,
agat$}
{gat$,
cat$,
at$,
t$}
BW order

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BW order

Graph has something like a BW order! Matching aga, we still have consecutivity.
BW order

Graph has something like a BW order!
Matching aga, we still have consecutivity.
BW order

Graph has something like a BW order!
Matching aga, we still have consecutivity.

\[ \{1, 2, 3\} \]

\[ \{5, 6\} \]

\[ \{1\} \]
BW order

Does it work for every graph?

\[ \text{(was } g) \]
BW order

Does it work for every graph?
BW order

Does it work for every graph?
BW order

Does it work for every graph?

\{gattacat$\}, \{attacat$\}, \{ttacat$\}, \{tacat$\}, \{acat$\}, \{tat$\}, \{tatat$\}, \{attatat$\}, \{gattatat$\}
BW order

Does it work for every graph?

\[
g, \{\text{attacat$}, \text{attatat$}\}
\]

\[
\{\text{ttacat$}, \text{ttatat$}\}
\]

\[
\{\text{tacat$}, \text{tagat$}\}
\]

\[
\{\text{acat$}, \text{atat$}\}
\]
BW order

Does it work for every graph?

No total order!

at$ is “sandwiched”
in \{acat$, atat$\}
BW order

Can we fix it?

g a t t a c a t t $
BW order

Can we fix it?

\[ g \rightarrow a \rightarrow t \rightarrow t \rightarrow a \rightarrow c \rightarrow a \rightarrow t \rightarrow \$ \]

\[ g \rightarrow a \rightarrow t \rightarrow t \rightarrow a \rightarrow c \rightarrow a \rightarrow t \rightarrow \$ \]
BW order

Can we fix it?

\{tacat$, tatatat$\}
BW order

Can we fix it?

\{\text{tacat$,$, tatat$}\}$

\text{Still \textbf{\textred{\texted{ed}}}}
BW order

Can we fix it?

$\text{g a t}$

$\text{t a c}$

$\text{a t}$

$\text{t}$$

$\text{g a t}$

$\text{t a c}$

$\text{a t}$

$\text{t}$$
Can we fix it?
BW order

For some graphs, total order exists

6 → 3 → 9 → 8 → 1 → 2 → 7 → 0 → $
BW order

For some graphs, total order exists

For others, not:
BW order

For some graphs, total order exists

For others, not:  (but we can “fix" them sometimes)
BW for graphs: TODO

Which graphs does it work for?

Do we have the consecutivity property, as needed for matching?

How do we represent and query the graph?