TCP CONGESTION CONTROL

ASSIGNMENT 4

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CS15B036

CONTENTS

TASK: To emulate the TCP congestion control algorithm, based on the given conditions.

TCP CONGESTION CONTROL

Congestion results from applications sending more data than the network devices can accommodate, thus causing the buffers on such devices to fill up and possibly overflow. Slow start and AIMD are some of the protocols that aim at tackling or controlling the congestion problem.

PARAMETERS:

- ***K_i*** **:** *$1 \le Ki \le 4$ denotes the initial congestion window (CW)*
- ***K_m*** **:** $0{:}5 \le Km \le 2$ denotes the multiplier of Congestion Window, during exponential growth phase
- ***K_n*****:** $0{:}5 \le Kn \le 2$ denotes the multiplier of Congestion Window, during linear growth phase
- ***K_f*****:** $0{:}1 \le Kf \le 0{:}5$ denotes the multiplier when a timeout occurs
- ***P* :** $0 < Ps < 1$, denotes the probability of receiving the ACK packet for a given segment before its timeout occurs
- ***T* :** the total number of segments to be sent before the emulation stops

PROCEDURE:

The file TCP.c simulates the TCP congestion control protocol as follows:

- Initial value of CW is set as $CW_{new} = K_i * MSS$.
- The congestion threshold is set to half of the current CW always.
- When a segment's ACK is successfully received during exponential growth phase, CW's value increases as $CW_{new} = \min(CW_{old} + K_m * MSS, RWS)$
- When a segment's ACK is successfully received during linear growth phase, CW's value increases as $CW_{new} = \min(CW_{old} + K_n * MSS * MSS/CW_{old}, RWS)$
- When a segment's ACK is not received, causing timeout, CW's value chamges as $CW_{new} = \max(1, K_f * CW_{old})$
- Probability P determines the probability with which a packet will be dropped.

The file is run accordingly:

- In terminal 1- *$gcc TCP.c -o TCP -lm*
- In terminal 1- *$./TCP K_i K_m K_n K_f P T*

Example:

$./TCP 1 1 1 0.5 0.01 1000

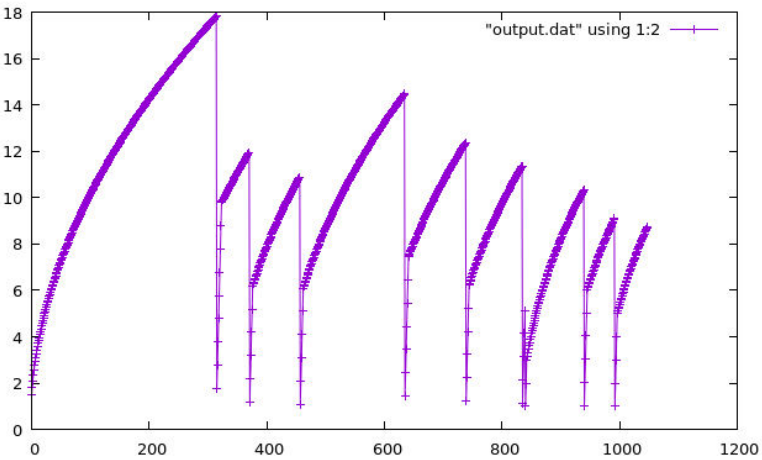
OBSERVATION:

1. Influence of K_m on CW:

CW value is directly proportional to K_m. Although, the value of CW (as shown in the following graphs) doesn't vary much with various values of K_m, when increasing exponentially.

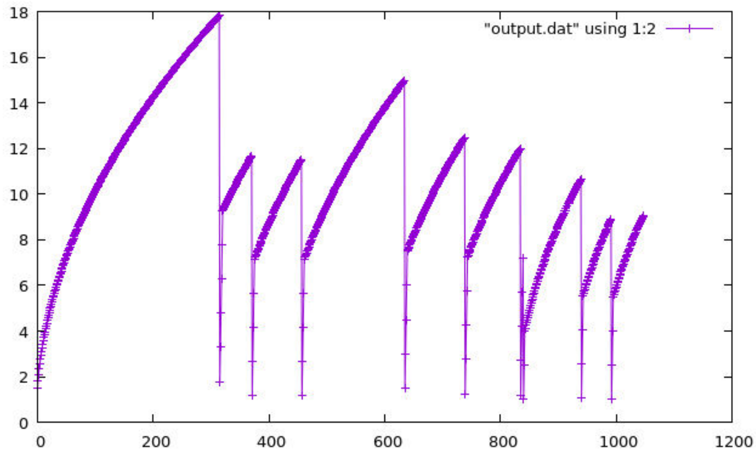
GRAPH 1:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



GRAPH 2:

$K_i = 1; K_m = 1.5; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$

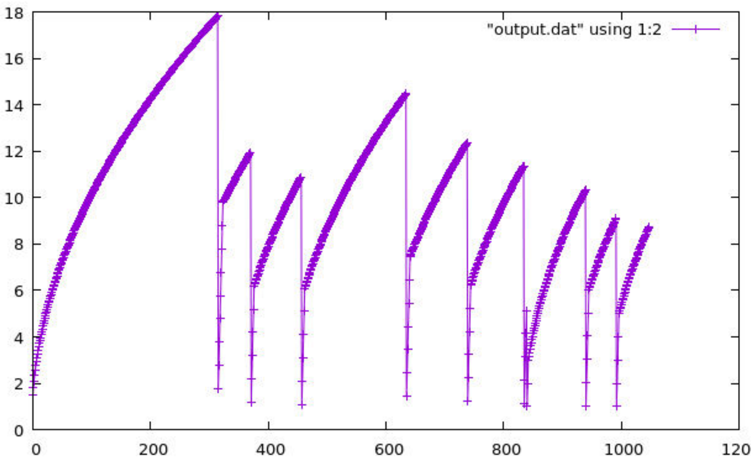


2. Influence of K_n on CW:

CW value is directly proportional to K_n. As shown in the following graphs, there is a significant increase in CW value with an increase in K_n, when increasing linearly.

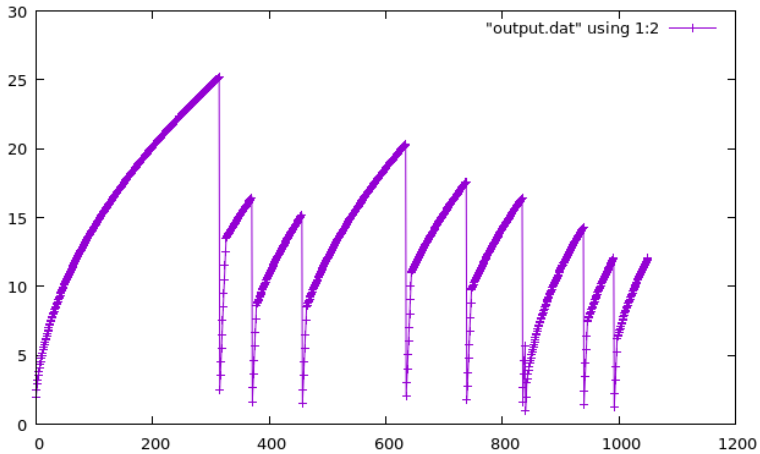
GRAPH 1:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



GRAPH 2:

$K_i = 1; K_m = 1; K_n = 1; K_f = 0.1; P = 0.01; T = 1000$

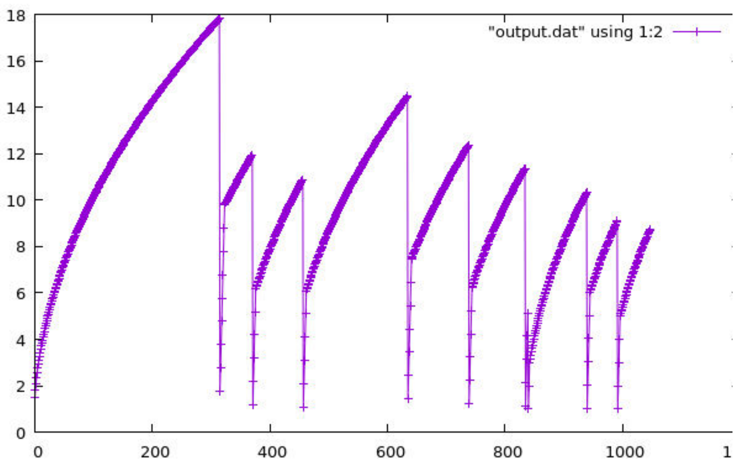


3.*Influence of K_f on CW:*

As shown in the following graphs, value of CW decreases by greater amount with smaller K_f. With a greater K_f , when there is a drop, CW falls to a greater value than it would have, had the K_f value been smaller.

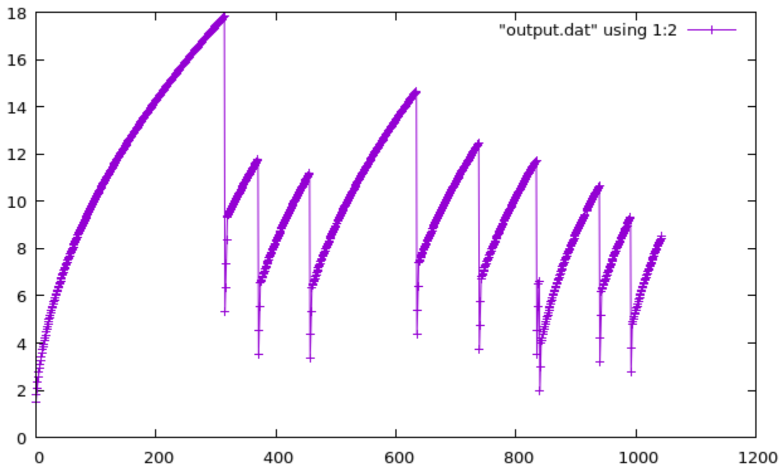
GRAPH 1:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



GRAPH 2:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.3; P = 0.01; T = 1000$

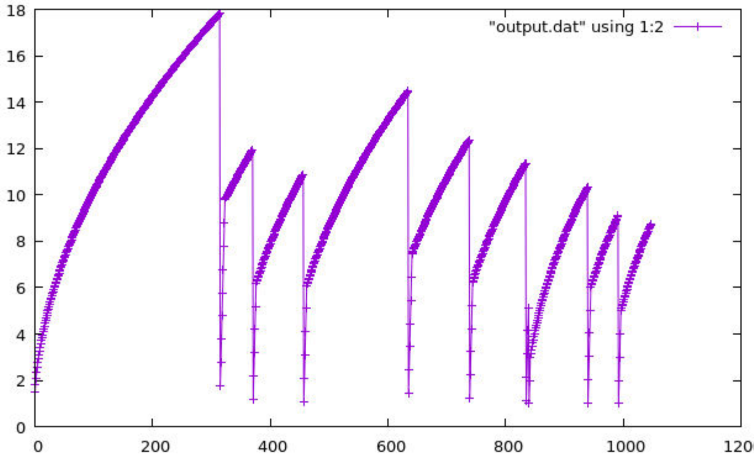


4. *Influence of K_i on CW:*

As shown in the following graphs, there is no effect on CW value due to K_i . The only effect K_i has on CW is that the initial value of CW is greate when the K_i is greater. There is no other change during the entire duration of the session.

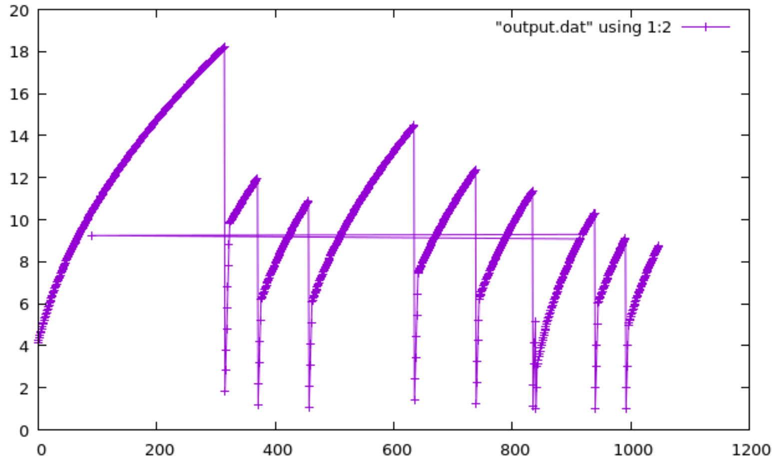
GRAPH 1:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



GRAPH 2:

$K_i = 4; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$

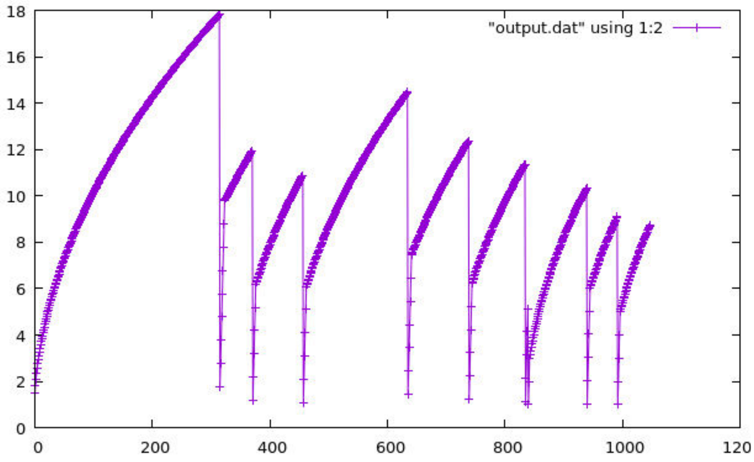


5. *Influence of P on CW:*

More the probability of drops, more are the drops and hence more number of falls of CW values. With a lesser probability of drops, the value of CW would reach a much larger value during the entire session than it would ever reach if the probability of drops is more, as can be seen from the following graphs.

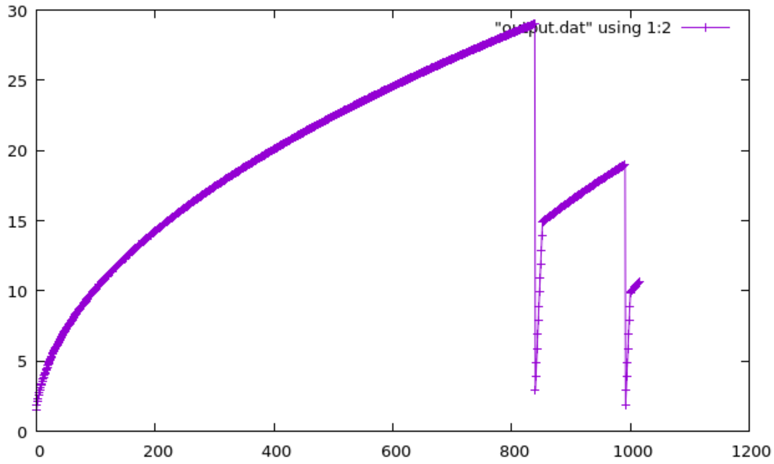
GRAPH 1:

$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



GRAPH 2:

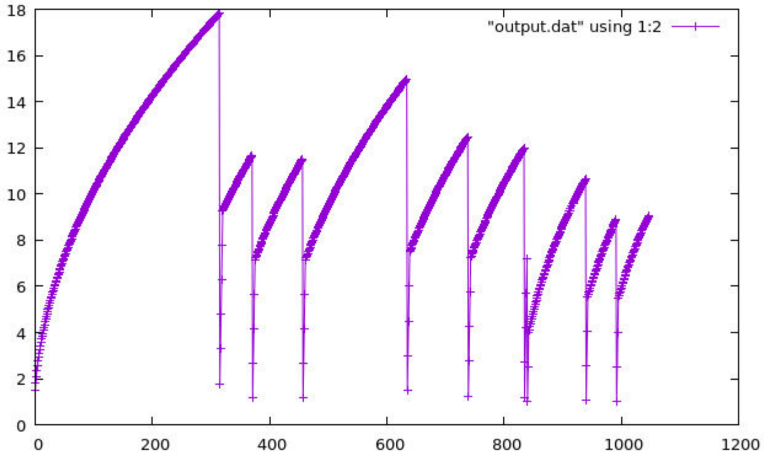
$K_i = 1; K_m = 1; K_n = 0.5; K_f = 0.1; P = 0.0001; T = 1000$



RESULTS:

GRAPHS:

$K_i = 1; K_m = 1.5; K_n = 0.5; K_f = 0.1; P = 0.01; T = 1000$



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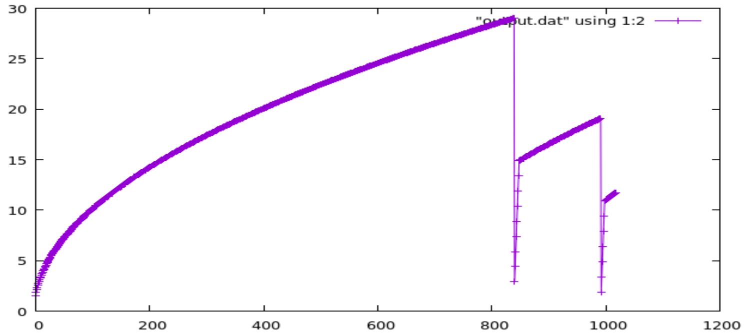

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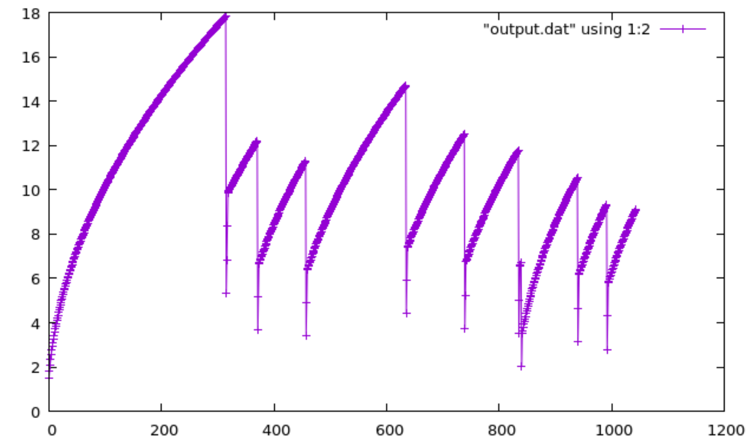

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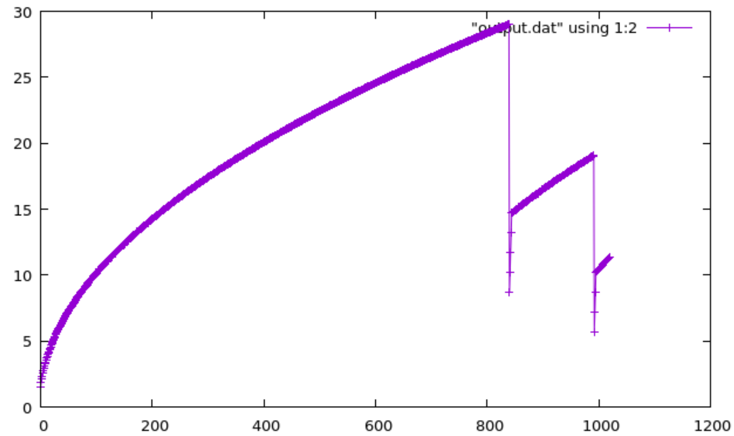

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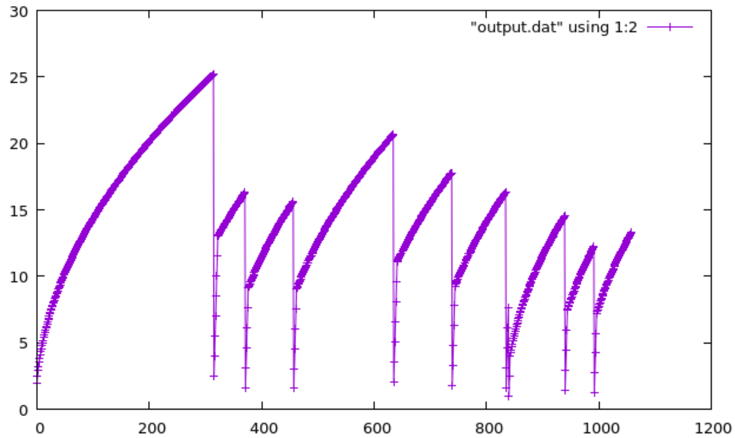

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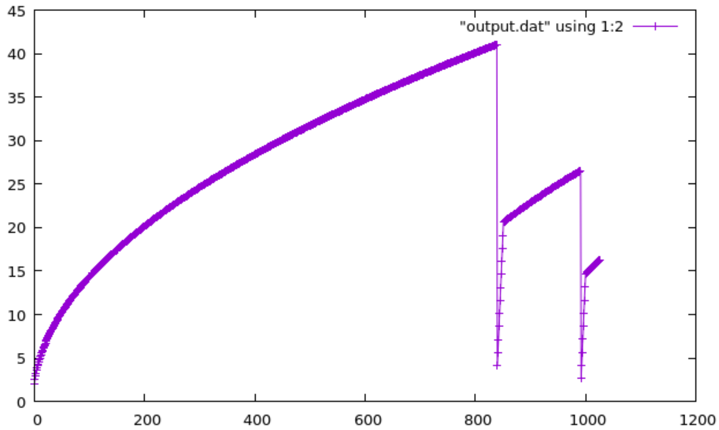

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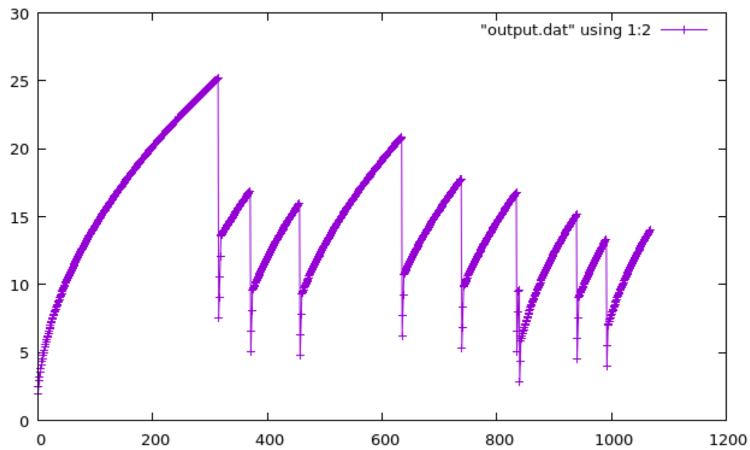

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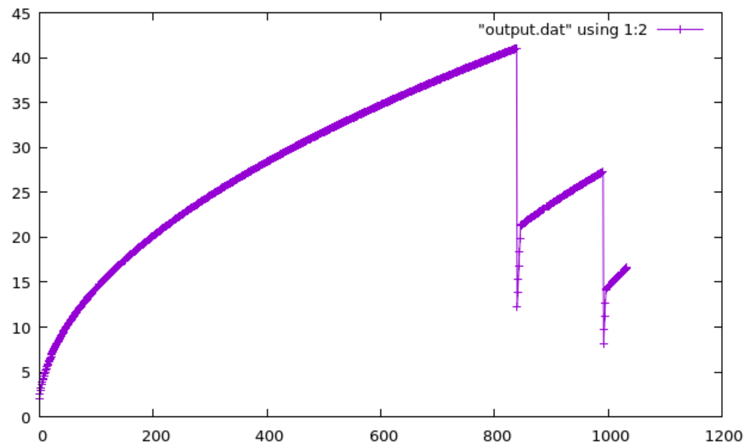

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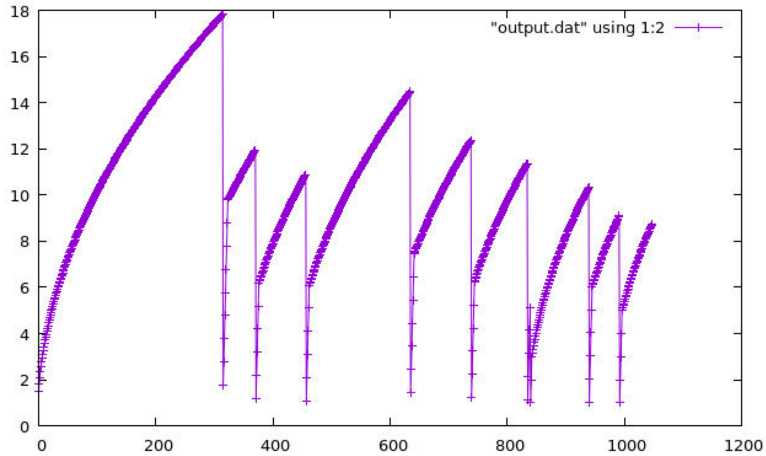

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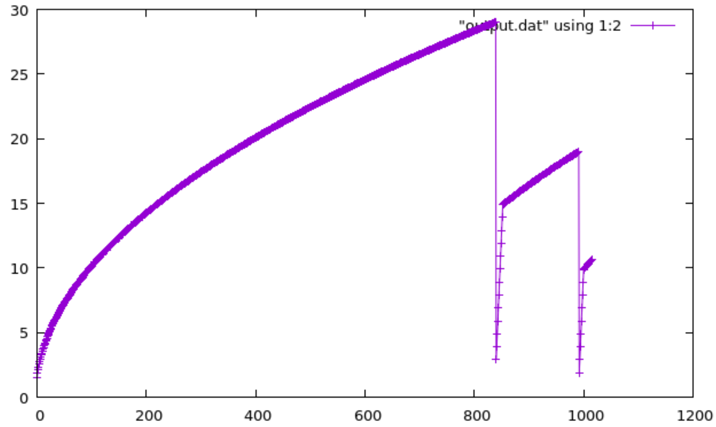

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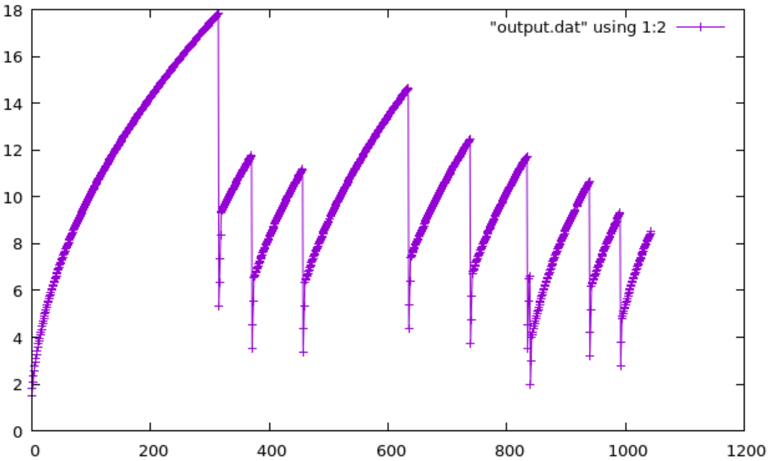

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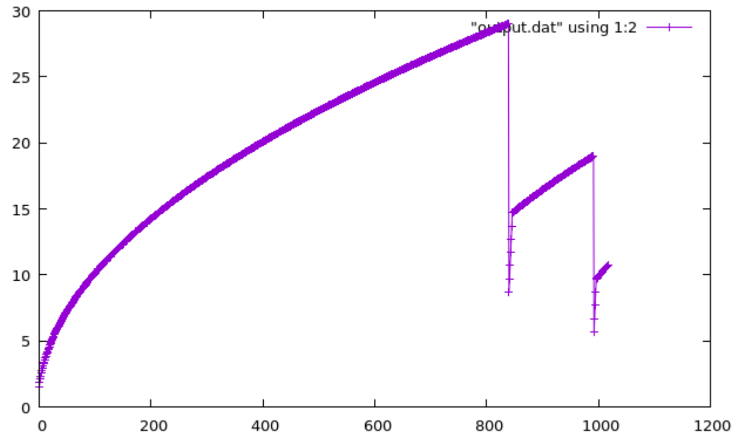

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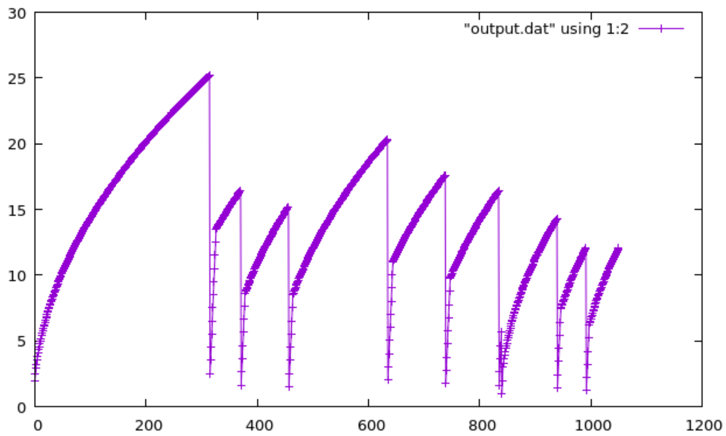

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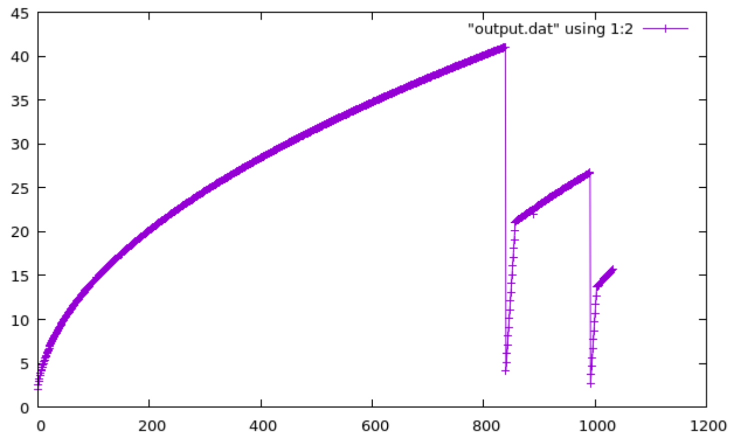

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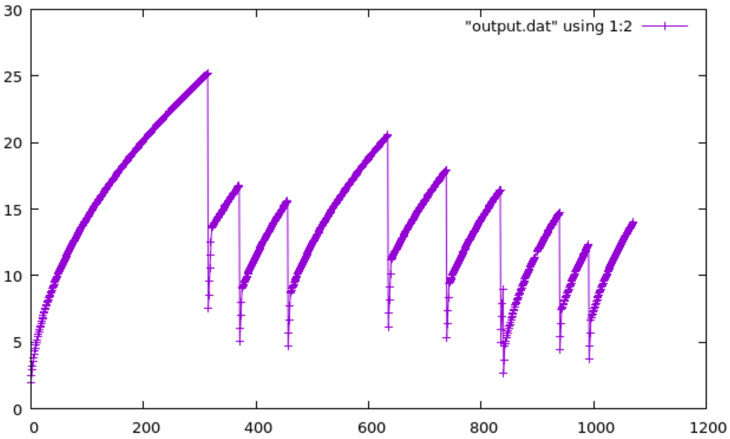

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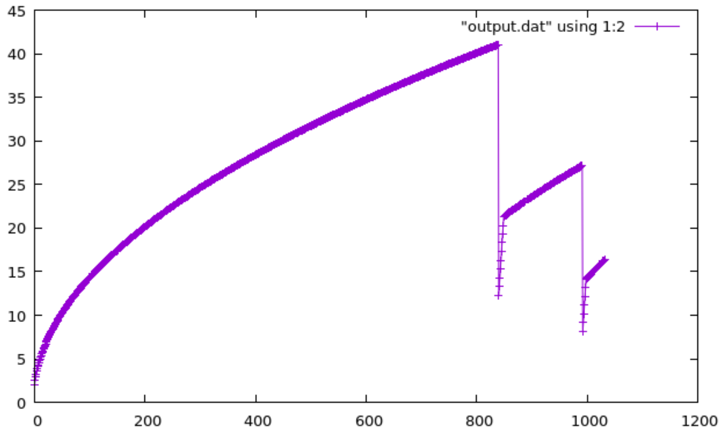

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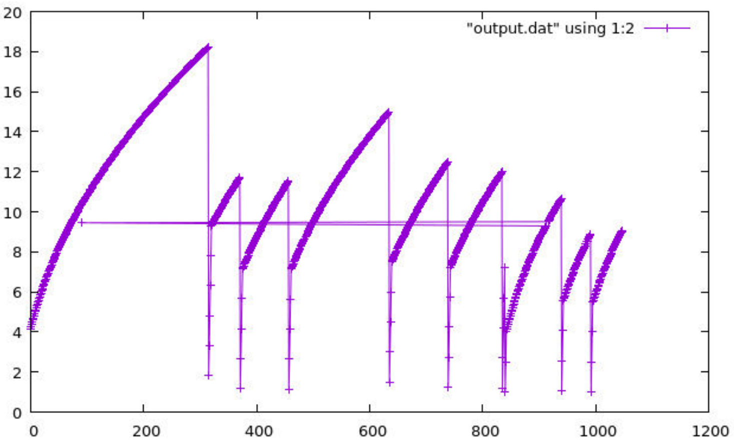

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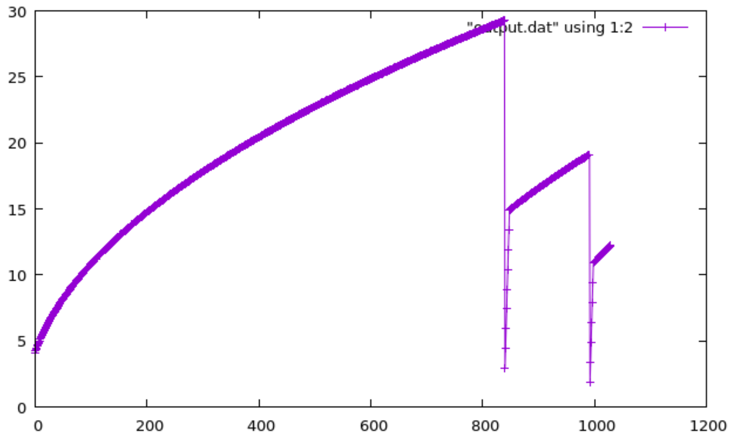

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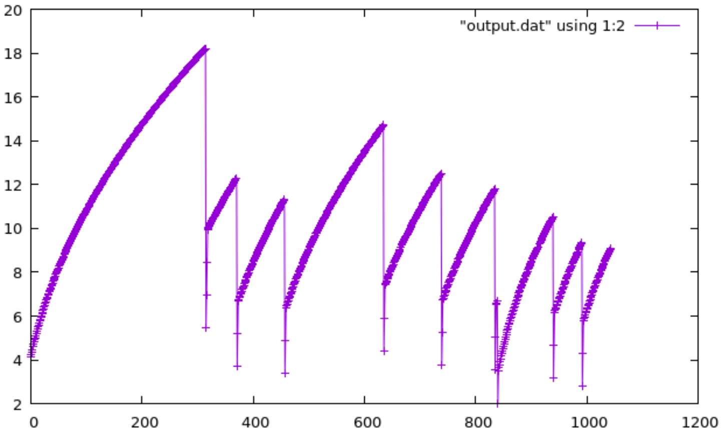

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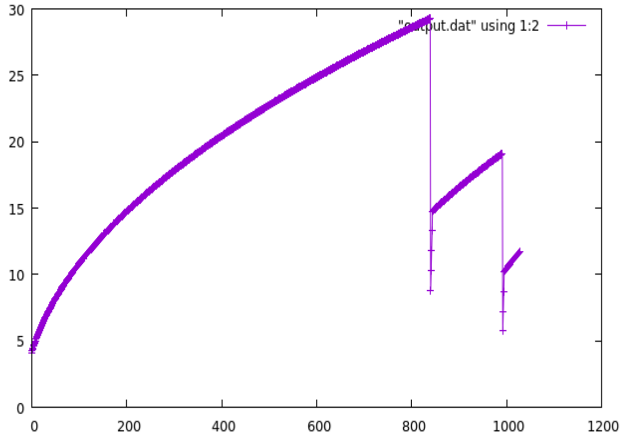

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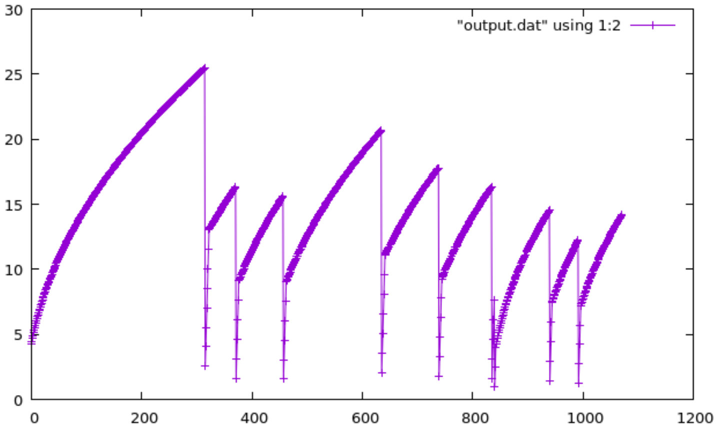

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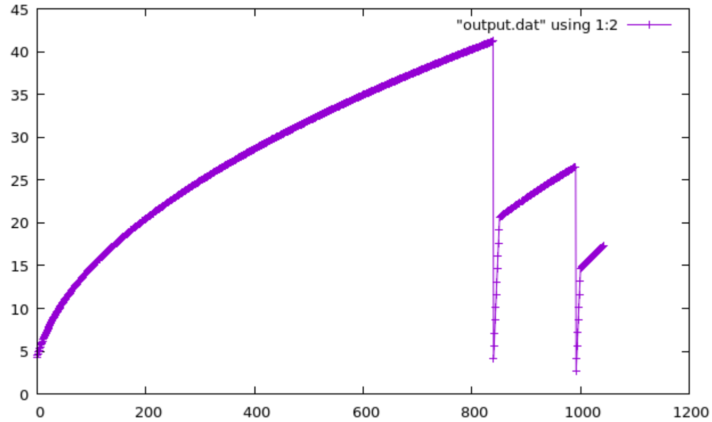

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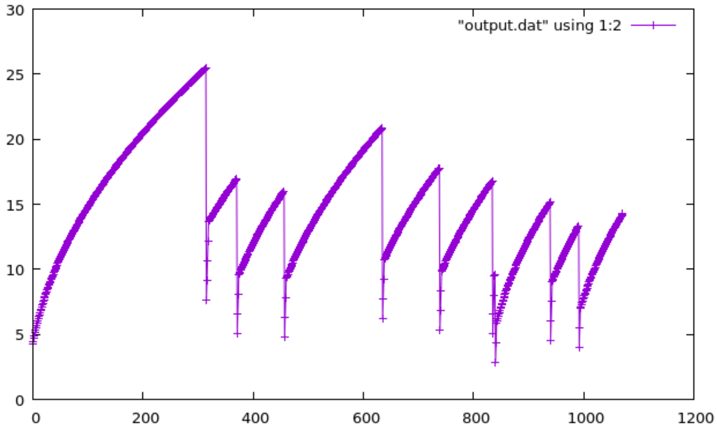

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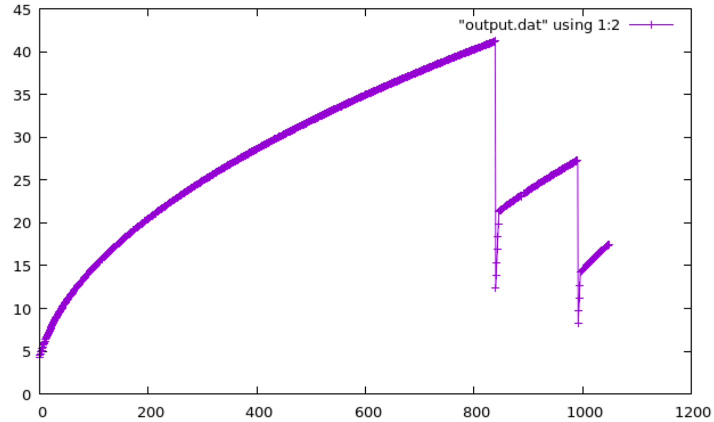

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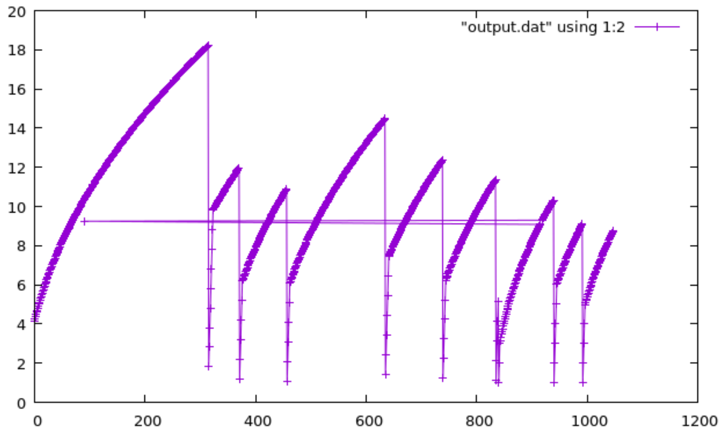

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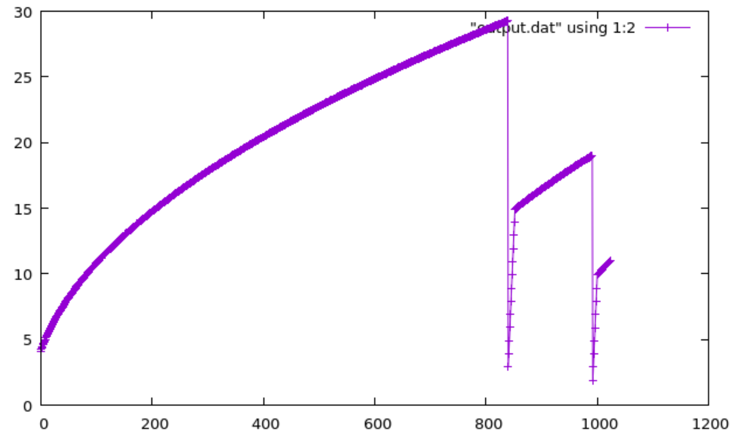

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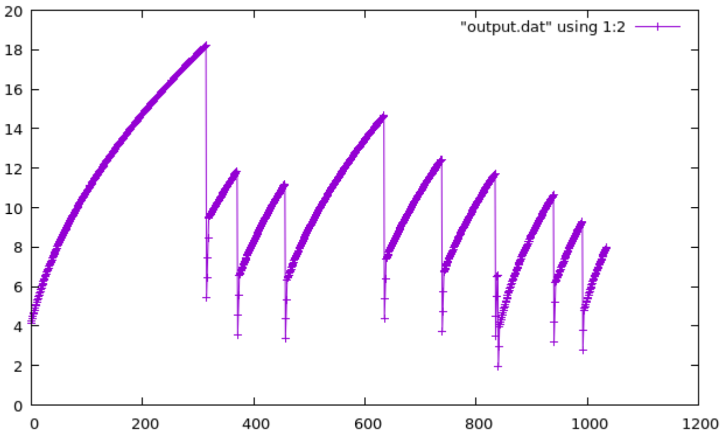

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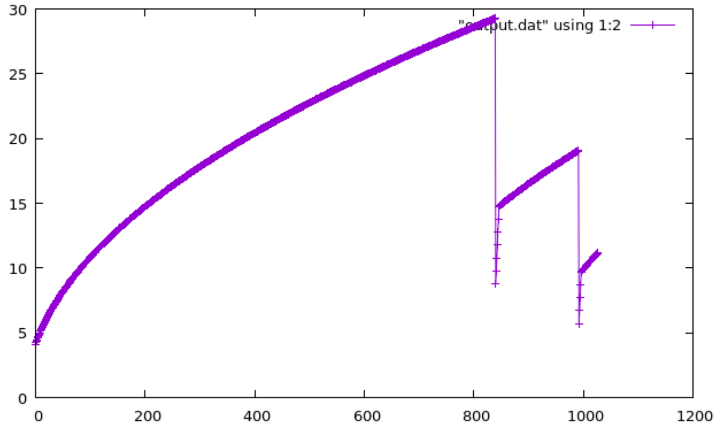

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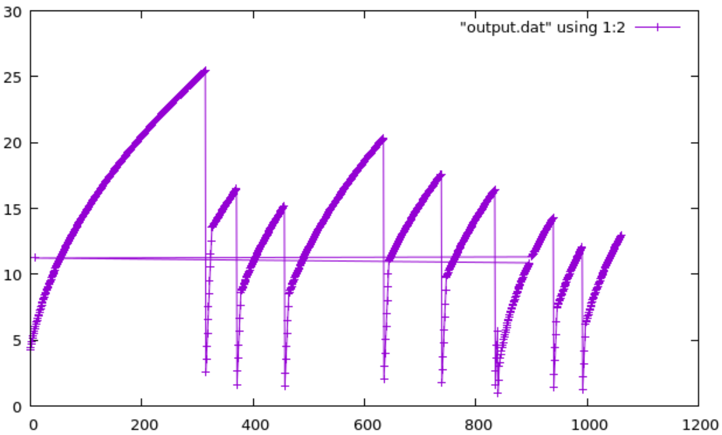

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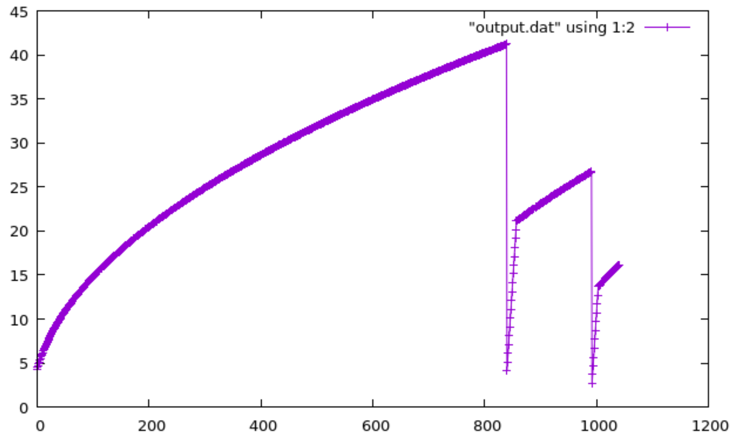

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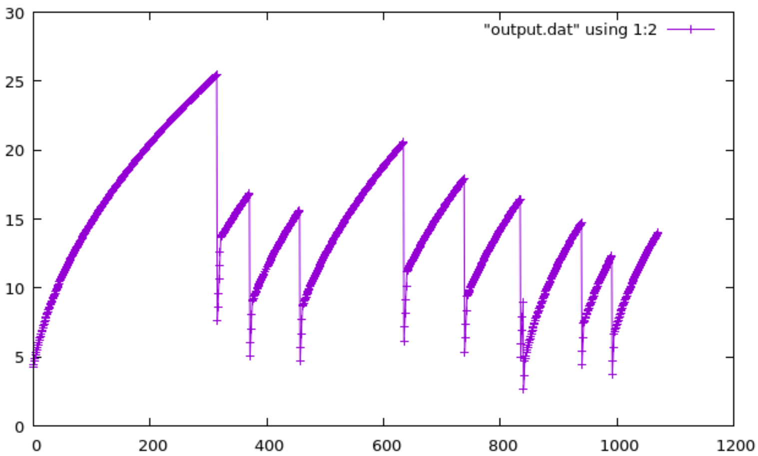

$K_i = 4; K_m = 1; K_n = 1; K_f = 0.3; P = 0.0001; T = 1000$