































It is obvious that

$$\max_{\{x_1, \dots, x_M\}} G[P_M(x)] \geq G[\tilde{P}(x)].$$

Since

$$\left| C - G[\tilde{P}(x)] \right| \leq \left| C - G[P(x)] \right| + \left| G[P(x)] - G[\tilde{P}(x)] \right| \leq \varepsilon$$

and

$$C \geq \max_{\{x_1, \dots, x_M\}} G[P_M(x)] \geq G[\tilde{P}(x)].$$

We get

$$\left| C - \max_{\{x_1, \dots, x_M\}} G[P_M(x)] \right| \leq \varepsilon,$$

then the lemma is valid. Q.E.D.

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