Assign #4

2. $$f(x) = \frac{-h(-1.0) + h(x)}{-h(-1.0) + h(0.8)} \qquad x \in [-1.0, 1.2]$$

where $$h(x) = x^2\left(1 - \frac{35}{32}x^2 + \frac{1}{3}x\right)$$

$$h(-1) = -\frac{41}{96} \qquad h(0.8) = \frac{136}{375}$$

$$f(x) = \frac{x^2(1 - 1.09375\,x^2 + 0.3333x) + 0.42708}{0.78975}$$

(a) $f'(x) = 0$

Using MatLAB

$x = -4/7\ ,\ 0,\ 4/5$

Check $f''(x)$

$f''(-4/7) < 0$ } maxima

$f''(4/5) < 0$ } maxima

$f''(0) > 0$ } minima.

$\Rightarrow$ $f(-4/7) = 0.7278$

$f(4/5) = 1.0$

$\Rightarrow$ Global max. $x = 4/5$

local max. $x = -4/7$.

(b) Theoretical growth.

(i) Proportionate selection.

$$P_{i,t} = \frac{\int_a^b f^t(x)\, p_0(x)\, dx}{\int_{-1.0}^{1.2} f^t(x)\, p_0(x)\, dx}.$$

(ii) For BTS & Linear ranking.

$$P_{i,t} = 1 - (1 - P_{i,0})^t$$

Global: $f^* = 1$ $\quad f^* - 0.1 = 0.9$.

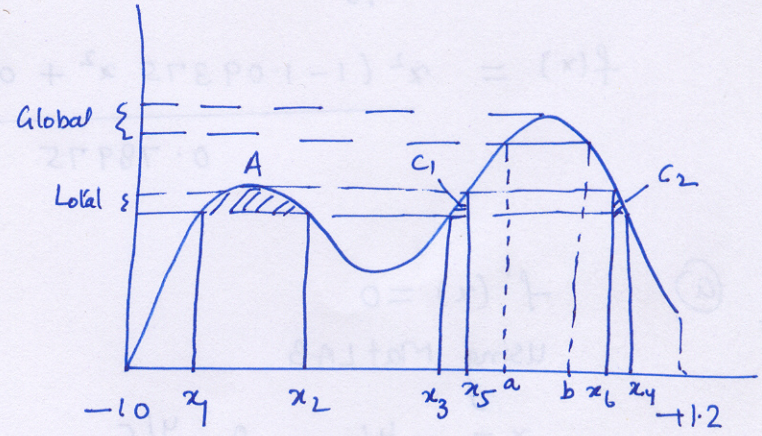
Local: $f^* = 0.7278$ $\quad f^* - 0.1 = 0.6278$

For global:

$f(x) = 0.9$ using MatLAB

$\Rightarrow$ $x_a = 0.5895$

$x_b = 0.9637$



for local:

$f(x) = 0.7278.$

$x_5 = 0.3917$

$x_6 = 0.0559$

$f(x) = 0.6278.$

$x_1 = -0.7575$ $\quad x_3 = 0.2607$

$x_2 = -0.2914$ $\quad x_4 = 0.093$

Proportionate Selection

for uniform distb^n (latin Hyper cube)

$$p_0(x) = \frac{1}{B-A} = \frac{1}{2.2}$$

$$P_{I,t} = \int_a^b \left(\frac{0.4271 + h(x)}{0.7898}\right)^t dx \Big/ \int_{-1.0}^{1.2} \left(\frac{0.4271 + h(x)}{0.7898}\right)^t dx$$

Global: $a = 0.9637$

$b = 0.5895$

Local: $a = -0.7575$

$b = -0.2914$

Gen	$P_{local,t}$	$P_{global,t}$
1	0.2168	0.2428
2	0.2053	0.3207
5	0.1323	0.5567
10	0.0375	0.8106
20	0.0	0.985

Binary T. S. and Linear ranking S.

$$P_{i,t} = 1 - (1 - P_{i,0})^{2^t}$$

Global:

$$P_{i,0} = \frac{f_{max} - f^*}{f_{max} - f_{min}} = \frac{1 - 0.9}{1 - 0} = 0.1$$

$$P_{i,t} = 1 - (0.9)^{2^t}$$

local: Proportion of $f^* = 0.7278$ & $f^* = 0.1$ is the Shaded region of A, C_1 & C_2 and we are interested to find out in the ~~or~~ shaded region of A.

Proportion of shaded part – A along abscissa

$$P(A) = \frac{x_2 - x_1}{2 \cdot 2} = 0.21186$$

Proportion of shaded parts C_1 & C_2 along abscissa

$$P(C) = \frac{(x_5 - x_3) + (x_4 - x_6)}{2 \cdot 2} = 0.0764$$

Hence the proportion of $f^* = 0.7278$ & $f^* = 0.1$ class

$$= P_{i,t} * \frac{0.21186}{0.21186 + 0.0764} = P_{i,t} * 0.735$$

where $P_{i,t} = P^2_{i,t} - P^1_{i,t}$

and For $P^1_{i,t}$

$$P^1_{i,0} = \frac{1 - 0.7278}{1 - 0} = 0.2722$$

$$P^1_{i,t} = 1 - (0.7278)^{2^t}$$

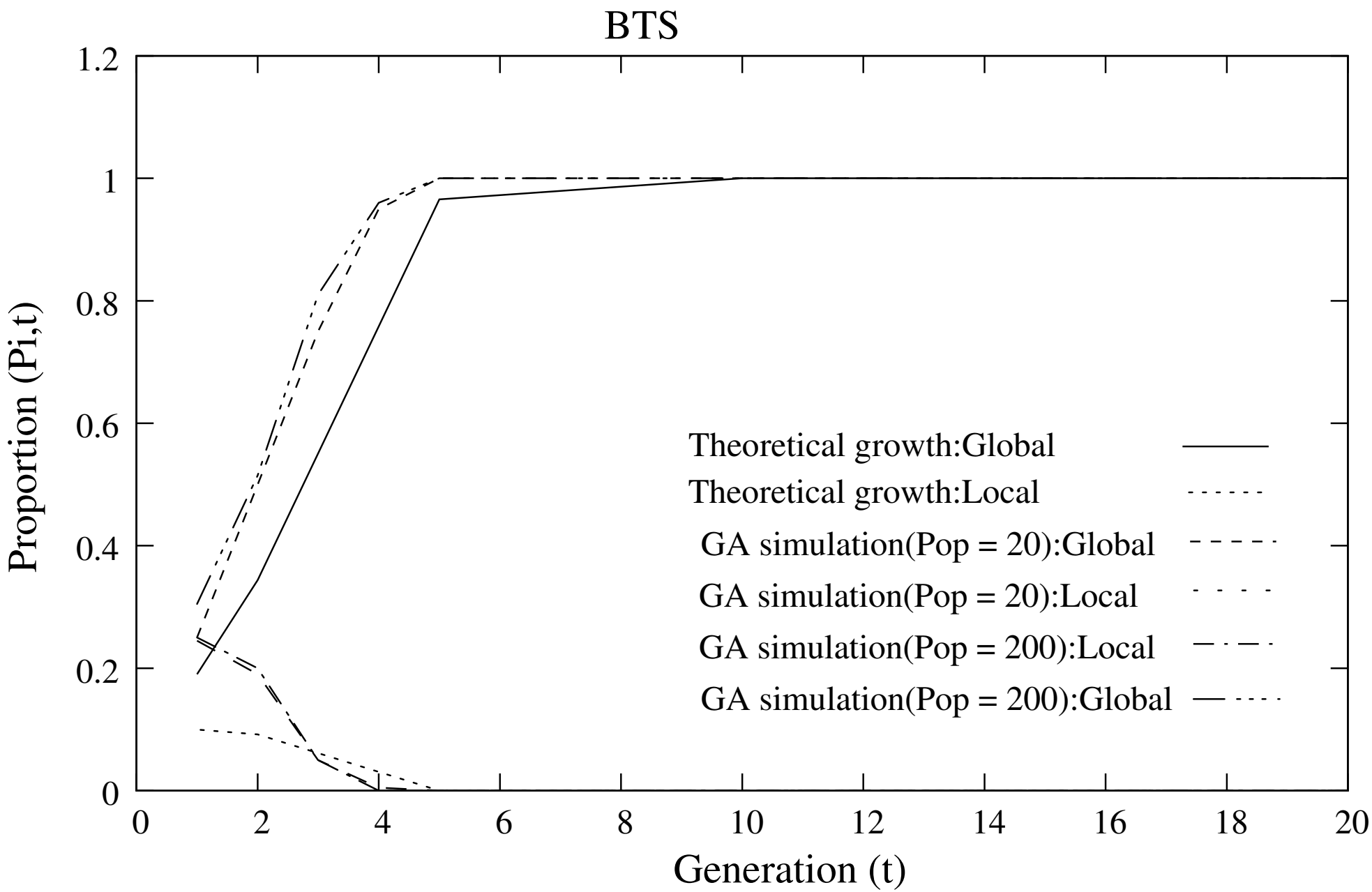
Similarly $P^2_{i,0} = \frac{1 - 0.6278}{1 - 0} = 0.3722$ $\quad P^2_{i,t} = 1 - (0.6278)^{2^t}$

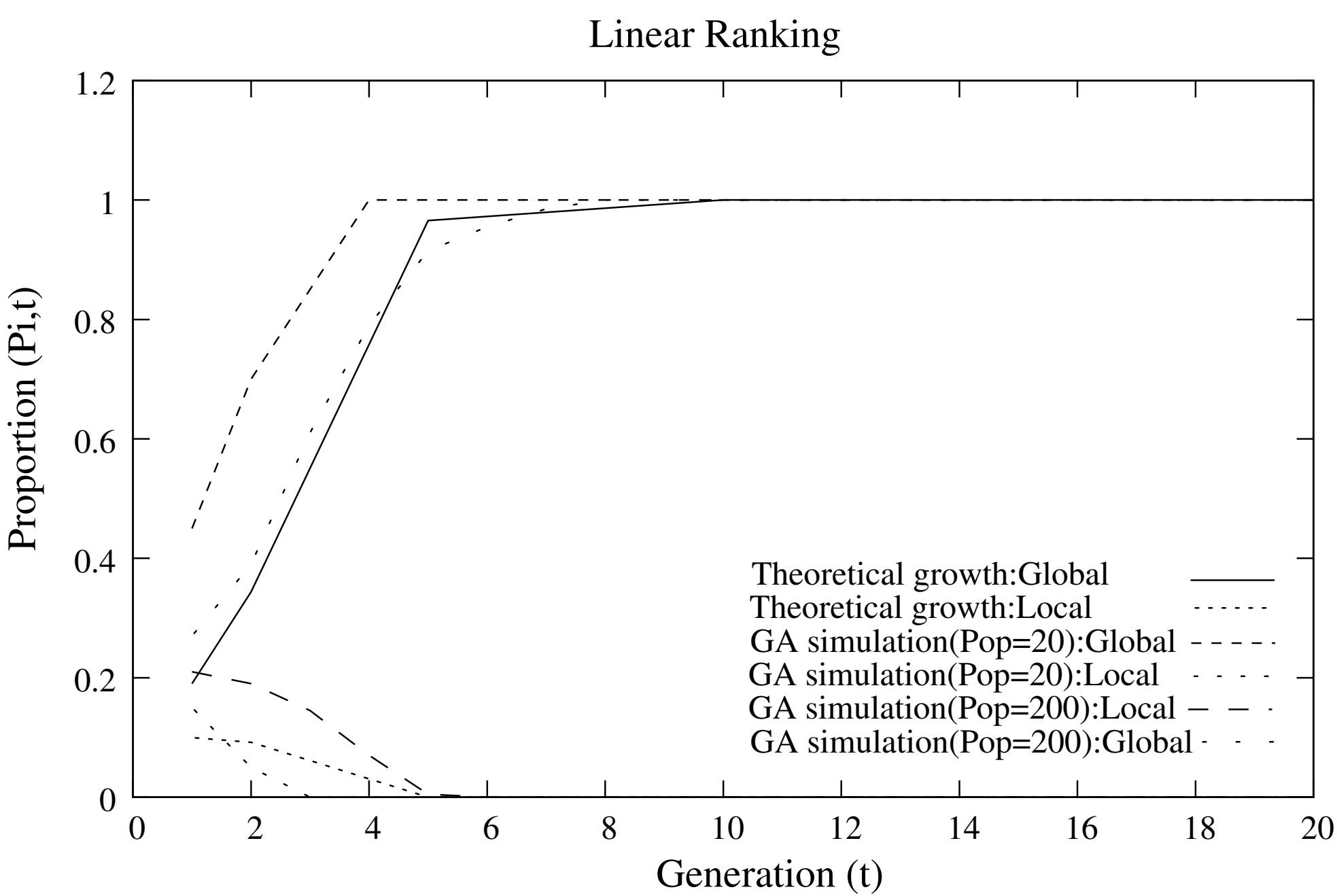
Hence

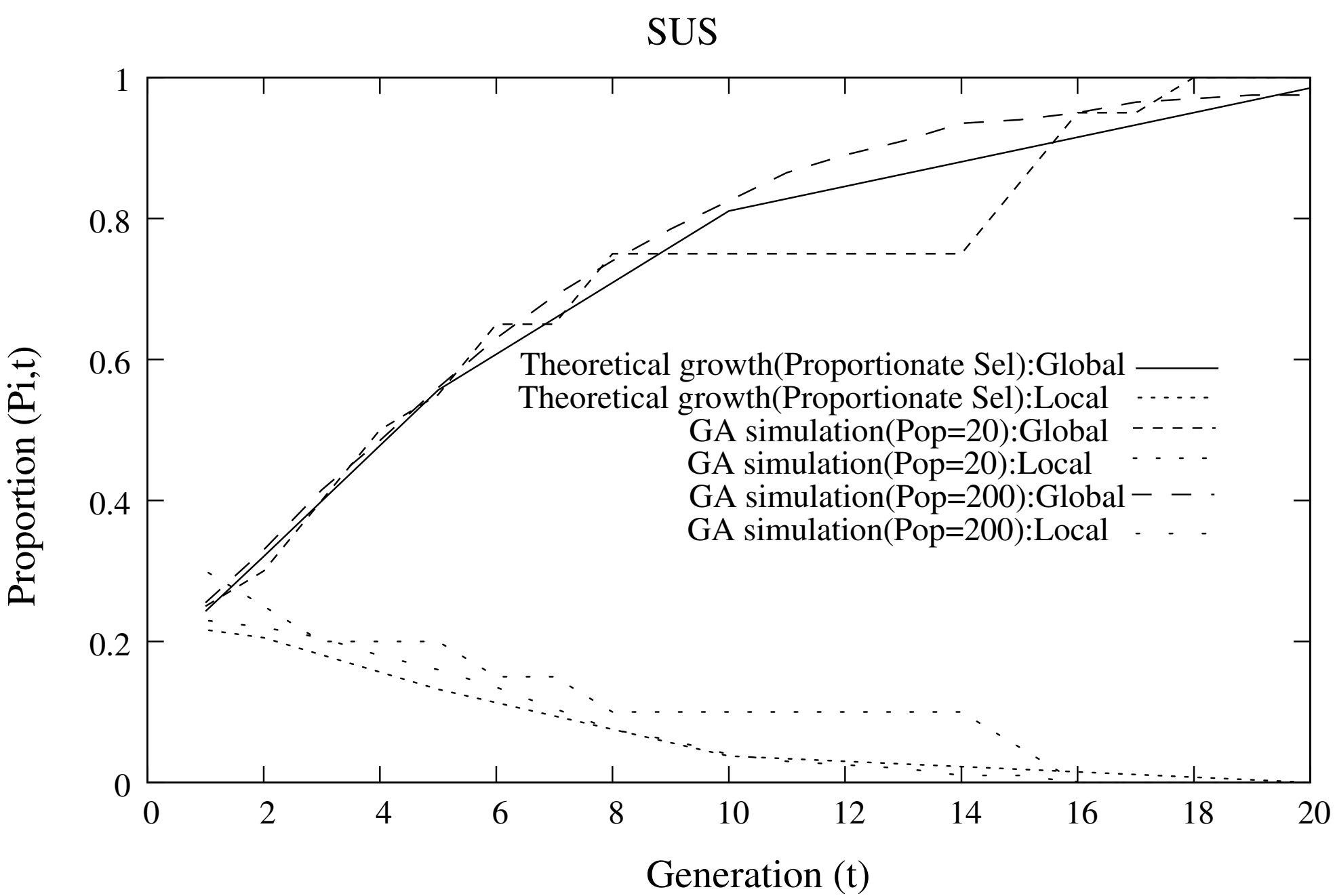
$$P_{i,t} = P^2_{i,t} - P^1_{i,t} = (0.7278)^{2^t} - (0.6278)^{2^t}$$

Proportion of class $= 0.735 \times P_{i,t}$

Hen	$P_{Global,t}$	$P_{local,t}$
1	0.19	0.09964
2	0.3439	0.09206
5	0.965663	0.0002794
10	1	0
20	1	0


BTS
1.2
1
0.8
0.6
0.4
0.2
0
Proportion (Pi,t)
0
2
4
6
8
10
12
14
16
18
20
Generation (t)
Theoretical growth:Global
Theoretical growth:Local
GA simulation(Pop = 20):Global
GA simulation(Pop = 20):Local
GA simulation(Pop = 200):Local
GA simulation(Pop = 200):Global


Linear Ranking
Proportion (Pi,t)
Generation (t)
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
14
16
18
20
Theoretical growth:Global
Theoretical growth:Local
GA simulation(Pop=20):Global
GA simulation(Pop=20):Local
GA simulation(Pop=200):Local
GA simulation(Pop=200):Global


SUS
Proportion (Pi,t)
Generation (t)
0
0.2
0.4
0.6
0.8
1
0
2
4
6
8
10
12
14
16
18
20
Theoretical growth(Proportionate Sel):Global
Theoretical growth(Proportionate Sel):Local
GA simulation(Pop=20):Global
GA simulation(Pop=20):Local
GA simulation(Pop=200):Global
GA simulation(Pop=200):Local