#Problem 1
The recursion is R(0)= c0,R(1) = c1,R(2) = c2, R(3) = p1 · R(2) +p2·R(1) +p3·R(0),...,R(n) = $p1 \cdot R(n-1) + p2 \cdot R(n-2) + p3 \cdot R(n-3)$
R(4) = p1·R(3)+p2·R(2)+p3·R(1) = p1·(p1·c2+p2·c1+p3·c0)+p2·c2+p3·c1
Problem 2

```
F := proc(p1, p2, p3, c0, c1, c2, n) option remember:
 if n = 0 then
   c0:
 elif n = 1 then
   c1:
elif n = 2 then
   c2:
 else
   expand(p1·F(p1, p2, p3, c0, c1, c2, n − 1) + p2·F(p1, p2, p3, c0, c1, c2, n − 2) + p3·F(p1, p2,
      p3, c0, c1, c2, n − 3))
 fi:
 end:
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seq(F(1, 1, 1, 1, 1, 1, i), i = 1 ..10);
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1, 1, 3, 5, 9, 17, 31, 57, 105, 193 **(1)**

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F(1, 1, 1, 1, 1, 1, 4)
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5 **(2)**

#Problem 3
(i) extinction

$$evalf\left(seq\left(F\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, 1, 1, 1, i\right), i = 1 ..10\right)\right);$$

1., 1., 0.7500000000, 0.6875000000, 0.6093750000, 0.5117187500, 0.4521484375, 0.3933105469, 0.3392944336, 0.2961883545 **(3)**

$$evalf\left(seq\left(F\left(\frac{1}{4}, \frac{1}{4}, \frac{1}{4}, 1, 1, 1, i\right), i = 990 ..1000\right)\right);$$

$4.468254626\ 10^{-61}$, $3.882363014\ 10^{-61}$, $3.373295354\ 10^{-61}$, $2.930978249\ 10^{-61}$, $2.546659154\ 10^{-61}$, $2.212733189\ 10^{-61}$, $1.922592648\ 10^{-61}$, $1.670496248\ 10^{-61}$, $1.451455521\ 10^{-61}$, $1.261136104\ 10^{-61}$, $1.095771968\ 10^{-61}$ **(4)**

(ii) stable population

$$evalf\left(seq\left(F\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 1, 1, 1, i\right), i = 1 ..10\right)\right);$$

1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1. **(5)**

$$evalf\left(seq\left(F\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}, 1, 1, 1, i\right), i = 990 ..1000\right)\right);$$

1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1. **(6)**

(iii) population explosion

$$evalf\left(seq\left(F\left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 1, 1, 1, i\right), i = 1 ..10\right)\right);$$

1., 1., 1.500000000, 1.750000000, 2.125000000, 2.687500000, 3.281250000, 4.046875000, 5.007812500, 6.167968750 **(7)**

$$evalf\left(seq\left(F\left(\frac{1}{2},\frac{1}{2},\frac{1}{2},1,1,1,i\right),i=990..1000\right)\right);$$

$$1.561649092\ 10^{90},\ 1.926687579\ 10^{90},\ 2.377054517\ 10^{90},\ 2.932695594\ 10^{90},\ 3.618218845\ 10^{90},\ 4.463984478\ 10^{90},\ 5.507449458\ 10^{90},\ 6.794826391\ 10^{90},\ 8.383130163\ 10^{90},\ 1.034270301\ 10^{91},\ 1.276032978\ 10^{91} \quad \textbf{(8)}$$