

```
In[32]:= Clear [pi, lambda, mu, s, Ka]; pi[n_, lambda_, mu_, s_, Ka_] :=
  If[n == 0, 1, If[n <= s, (lambda/mu) ^ n / (n!), (lambda/mu) ^ n / ((s!) * s^(n-s))] /
  Sum[If[k == 0, 1, If[k <= s, (lambda/mu) ^ k / (k!), (lambda/mu) ^ k / ((s!) * s^(k-s))]], {k, 0, Ka}];
```

```
In[39]:= Clear [LL, LLs, LLq, WW, WWS, WWq, lambda, mu, s, Ka];
LL[lambda_, mu_, s_, Ka_] := Sum[n * pi[n, lambda, mu, s, Ka], {n, 0, Ka}];
WWS[lambda_, mu_, s_, Ka_] := 1/mu; LLs[lambda_, mu_, s_, Ka_] := If[Ka < Infinity,
  lambda * (1 - pi[Ka, lambda, mu, s, Ka]) * WWS[lambda, mu, s, Ka], lambda * WWS[lambda, mu, s, Ka]];
LLq[lambda_, mu_, s_, Ka_] := LL[lambda, mu, s, Ka] - LLs[lambda, mu, s, Ka];
WWq[lambda_, mu_, s_, Ka_] := If[Ka < Infinity,
  LLq[lambda, mu, s, Ka] / (lambda * (1 - pi[Ka, lambda, mu, s, Ka])), LLq[lambda, mu, s, Ka] / lambda];
WW[lambda_, mu_, s_, Ka_] := WWS[lambda, mu, s, Ka] + WWq[lambda, mu, s, Ka];
```

Exercise 9.21

```
In[62]:= {LL[1/4, 1/2, 1, Infinity], WWq[1/4, 1/2, 1, Infinity], WW[1/4, 1/2, 1, Infinity]}
```

```
Out[62]:= {1, 2, 4}
```

Exercise 9.27

```
In[56]:= FullSimplify[{LL[lambda, mu, 1, Ka] / (lambda * (1 - pi[Ka, lambda, mu, 1, Ka])) -
  (LL[lambda, mu, 1, Ka] + 1 - (Ka + 1) * pi[Ka, lambda, mu, 1, Ka]) / (mu * (1 - pi[Ka, lambda, mu, 1, Ka])),
  LL[lambda, mu, 1, Ka] / (lambda * (1 - pi[Ka, lambda, mu, 1, Ka])) - 1/mu -
  (LL[lambda, mu, 1, Ka] - Ka * pi[Ka, lambda, mu, 1, Ka]) / (mu * (1 - pi[Ka, lambda, mu, 1, Ka])),
  (LL[lambda, mu, 1, Ka] / (lambda * (1 - pi[Ka, lambda, mu, 1, Ka])) - 1/mu) *
  lambda * (1 - pi[Ka, lambda, mu, 1, Ka]) -
  (LL[lambda, mu, 1, Ka] - (1 - pi[0, lambda, mu, 1, Ka]))}, Assumptions -> Ka > 1]
```

```
Out[56]:= {0, 0, 0}
```

Exercise 9.28

```
In[40]:= FullSimplify[LL[lambda, lambda, 1, Ka], Assumptions -> Ka >= 1]
```

```
Out[40]:=  $\frac{Ka}{2}$ 
```

Exercise 9.29

```
In[42]:= N[{WW[1/15, 1/10, 1, 3], WWq[1/15, 1/10, 1, 3], pi[3, 1/15, 1/10, 1, 3]}]
```

```
Out[42]:= {17.3684, 7.36842, 0.123077}
```

Exercise 9.30

```
In[61]:= Clear [additional]; additional = 0;
While[N[pi[4 + additional + 8, 1/20, 1/120, 4 + additional, 4 + additional + 8]] >= 0.2,
  additional = additional + 1]; additional
```

```
Out[61]:= 1
```