1.

```
P = trans(10)
```

```
P = 11×11
         0    1.0000         0         0         0         0         0         0 ···
    0.0100    0.1800    0.8100         0         0         0         0         0
         0    0.0400    0.3200    0.6400         0         0         0         0
         0         0    0.0900    0.4200    0.4900         0         0         0
         0         0         0    0.1600    0.4800    0.3600         0         0
         0         0         0         0    0.2500    0.5000    0.2500         0
         0         0         0         0         0    0.3600    0.4800    0.1600
         0         0         0         0         0         0    0.4900    0.4200
         0         0         0         0         0         0         0    0.6400
         0         0         0         0         0         0         0         0
    ⋮
```

2.

E(X_0)=10 because is given.

E(X_5)

```
a = zeros(1,11); a(1,11)=1;

E5=expected(P,5,a)
```

```
E5 = 6.6384
```

E(X_10):

```
E10=expected(P,10,a)
```

```
E10 = 5.5369
```

E(X_15):

```
E15=expected(P,15,a)
```

```
E15 = 5.1759
```

E(X_20):

```
E20=expected(P,20,a)
```

```
E20 = 5.0576
```

3. Eigenvalues of P:

```
eig(P)'
```

```
ans = 1×11
    1.0000    0.8000    0.6200    0.4600    0.3200    0.2000    0.1000    0.0200 ···
```

```
function y = expected(P,n,a)
result = 0;
pmf = a*P^n;
for i=0:10
    result = result + i*pmf(i+1);
end
y = result;
pmf;
end

function y = trans(N)
P = zeros(N+1); % make matrix of size N+1 to include case i=0
for i=0:N
    for j=0:N
        if i==0 & j==0 % case i=j=0
            P(1,1)=0;
        elseif i==N & j==N-1 % case i=N and j=N-1
            P(i+1,j+1)=1;
        elseif i==j & i>0 % case i==j
            P(i+1,i+1)= ri(i,N);
        elseif j==(i-1) % case j=i-1
            P(i+1,j+1)=qi(i,N);
        elseif j==(i+1)
            P(i+1,j+1)=pi(i,N);
    end
    end

end
y=P;
end

function y = ri(i,N) % from i to i
    y = 2*(i/N)*(N-i)/N;
end

function y = qi(i,N) % from i to i-1
y = (i/N)^2;
end

function y = pi(i,N) % from i to i+1
y = ((N-i)/N)^2;
end
```