1. Calculate the Variances and the covariance of Auto and Home deductibles for the following insurance company.

**Home**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Auto** | **0** | **1000** | **2000** | **5000** |  |
| 250 | 0.04 | 0.06 | 0.05 | 0.03 | 0.18 |
| 500 | 0.07 | 0.10 | 0.20 | 0.10 | 0.47 |
| 1000 | 0.02 | 0.03 | 0.15 | 0.15 | 0.35 |
| Col Total | 0.13 | 0.19 | 0.40 | 0.28 | 1.00 |

**Solution: (Calculations in the attached file: Question 1.xlsx)**

|  |  |
| --- | --- |
| Variance(Auto) | **81850** |
| Variance(Home) | **3077900** |
| Covariance(Auto,Home) | **151800** |

1. Calculate the covariance of the Auto and Home deductibles for the following company.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Auto** | **0** | **1000** | **2000** | **5000** | **Row Total** |
| 250 | 0.02 | 0.04 | 0.08 | 0.06 | 0.20 |
| 500 | 0.05 | 0.10 | 0.20 | 0.15 | 0.50 |
| 1000 | 0.03 | 0.06 | 0.12 | 0.09 | 0.30 |
| **Col. Total** | 0.10 | 0.20 | 0.40 | 0.30 | 1.00 |

**Solution: (Calculations in the attached file: Question 2.xlsx)**

|  |  |
| --- | --- |
| Covariance(Auto,Home) | **0** |

1. Show that Var(x) is the same as E(X^2)-(E(x))^2

**Solution:**

Var(X)= E[(X-µ)^2]

=∑(x- µ)^2 \* p(x)

=∑ (x^2 – (2\*x\* µ) + µ^2)\*p(x)

=∑x^2p(x)- 2 µ∑x\*p(x) +( µ^2∑p(x))

=E(X^2)-2 µ^2 + µ^2

=E[X^2]- µ^2

= E[X^2]-(E[X])^2

Hence Proved.

1. Show that E(x+y)= E(x)+ E(y)

**Solution:**

E(X+Y)= **∑x, y** ((x+ y)\*P(X=x, Y=y))

= **∑x, y** (x\* P (X=x, Y=y)) **+ ∑x, y** (y\* P(X=x, Y=y))

**=**  **∑** x \* **∑y** P (X=x, Y=y) + **∑** y \* **∑x** P (X=x, Y=y)

Using total probability, **∑y** P (X=x, Y=y) =P(X=x) and **∑x** P (X=x, Y=y) =P(Y=y)

= **∑x** x\*P(X=x) + **∑y** y\*P(Y=y)

E[X]+E[Y]

Hence Proved

1. Show that Covar(x,y)=0 if x and y are independent

Covar(X,Y)= E(XY) - µ(x) µ(y)

If x and y are independent, E(XY)=E(X)\*E(Y)

= E(X)\*E(Y) - µ(x) µ(y)

= µ(x) µ(y)- µ(x) µ(y)

=0

Hence Proved

1. Show that Var(x+y)=Var(x)+Var(y) if x and y are independent.

Var(X+Y)=E[(X+Y)^2] - E(X+Y)^2

= E[X^2+2XY+Y^2] - ( µ(x) +µ(y))^2

= E[X^2+2XY+Y^2] - (µ(x)^2 +2 µ(x) µ(y)+µ(y)^2)

= E[X^2]- µ(x)^2 + E[Y^2]- µ(y)^2 +2(E[XY]- µ(x) µ(y))

=Var(X) +Var(Y) +2Covar(X,Y)

We proved earlier that Covar(x,y)=0 if x and y are independent

=Var(X)+Var(Y)

Hence Proved.