1. Objective :

This analysis aims to identify crime patterns across victim demographics, time periods, and crime domains to support data-driven decision-making for crime prevention and case resolution strategies.

In [57]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

2. Dataset Overview :

- Records represent reported crime incidents
- Each row corresponds to one reported case
- Key dimensions include victim demographics, crime type, time of occurrence, and case status

In [58]:
```
df = pd.read_excel('crime_dataset_india.xlsx')
df
```

Out[58]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16.0	M	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37.0	M	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48.0	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49.0	F	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30.0	F	NaN	NaN	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	NaN	78.0	F	Firearm	NaN	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75.0	F	NaN	NaN	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	NaN	M	NaN	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11.0	M	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43.0	F	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

3. Data Understanding :

In [59]:
```
df.head()
```

Out[59]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16.0	M	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37.0	M	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48.0	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49.0	F	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30.0	F	NaN	NaN	18.0	Yes

In [60]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 40160 entries, 0 to 40159
Data columns (total 11 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Report Number      40160 non-null  int64
 1   Date Reported      40160 non-null  datetime64[ns]
 2   City               40160 non-null  object
 3   Crime Code         40160 non-null  int64
 4   Crime Description  40099 non-null  object
 5   Victim Age         40112 non-null  float64
 6   Victim Gender      35828 non-null  object
 7   Weapon Used        28694 non-null  object
 8   Crime Domain       17212 non-null  object
 9   Police Deployed    40104 non-null  float64
 10  Case Closed        40160 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(2), object(6)
memory usage: 3.4+ MB
```

In [61]:
```
df.describe()
```

Out[61]:

	Report Number	Date Reported	Crime Code	Victim Age	Police Deployed
count	40160.000000	40160	40160.000000	40112.000000	40104.000000
mean	20080.500000	2022-04-18 03:29:56.952191232	349.360259	44.490726	10.009051
min	1.000000	2020-01-01 05:00:00	100.000000	10.000000	1.000000
25%	10040.750000	2021-02-24 02:00:00	225.000000	27.000000	5.000000
50%	20080.500000	2022-04-18 05:00:00	349.000000	44.000000	10.000000
75%	30120.250000	2023-06-10 10:00:00	474.000000	62.000000	15.000000
max	40160.000000	2024-08-02 18:00:00	599.000000	79.000000	19.000000
std	11593.337742	NaN	144.169205	20.225056	5.470105

In [62]:
```
df.isna().sum()
```

Out[62]:
```
Report Number            0
Date Reported            0
City                     0
Crime Code               0
Crime Description       61
Victim Age              48
Victim Gender         4332
Weapon Used          11466
Crime Domain         22948
Police Deployed         56
Case Closed              0
dtype: int64
```

4. Data Cleaning :

In [63]:
```
df['Victim Gender'] = df['Victim Gender'].replace({'M' : 'Male', 'F' : 'Female'})
df
```

Out[63]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16.0	Male	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37.0	Male	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48.0	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49.0	Female	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30.0	Female	NaN	NaN	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	NaN	78.0	Female	Firearm	NaN	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75.0	Female	NaN	NaN	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	NaN	Male	NaN	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11.0	Male	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43.0	Female	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

In [64]:
```
df['Crime Description'] = df['Crime Description'].fillna('Unknown')
df
```

Out[64]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16.0	Male	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37.0	Male	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48.0	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49.0	Female	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30.0	Female	NaN	NaN	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78.0	Female	Firearm	NaN	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75.0	Female	NaN	NaN	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	NaN	Male	NaN	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11.0	Male	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43.0	Female	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

In [65]:
```
df['Victim Age'] = df['Victim Age'].fillna(df['Victim Age'].mean()).astype('int64')
df
```

Out[65]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	NaN	NaN	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	NaN	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	NaN	NaN	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	NaN	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

In [66]:
```
df['Weapon Used'] = df['Weapon Used'].fillna('Unknown')
df
```

Out[66]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	NaN	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	NaN	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	NaN	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	NaN	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	NaN	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	NaN	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

In [67]:
```
df['Crime Domain'] = df['Crime Domain'].fillna('Unknown')
df
```

Out[67]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13.0	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9.0	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15.0	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1.0	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18.0	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12.0	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2.0	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6.0	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1.0	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7.0	Yes

40160 rows × 11 columns

In [68]:
```
df['Police Deployed'] = df['Police Deployed'].fillna(df['Police Deployed'].mean()).astype('int64')
df
```

Out[68]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	Yes

40160 rows × 11 columns

In [69]:
```
df['Victim Gender'] = df['Victim Gender'].fillna('Unknown')
df
```

Out[69]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	No
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	No
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	No
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	Yes
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	Yes
...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	No
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	Yes
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	No
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	No
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	Yes

40160 rows × 11 columns

In [70]:
```
df['Crime Month'] = df['Date Reported'].dt.month_name()
df
```

Out[70]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	No	January
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	No	January
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	No	January
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	Yes	January
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	Yes	January
...	...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	No	August
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	Yes	July
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	No	August
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	No	August

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	Yes	July

40160 rows × 12 columns

In [71]:
```
df['Crime Year'] = df['Date Reported'].dt.year
df
```

Out[71]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month	Crime Year
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	No	January	2020
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	No	January	2020
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	No	January	2020
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	Yes	January	2020
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	Yes	January	2020
...	...	...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	No	August	2024
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	Yes	July	2024
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	No	August	2024
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	No	August	2024

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month	Crime Year
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	Yes	July	2024

40160 rows × 13 columns

In [72]:
```
df['Case Status'] = df['Case Closed'].replace({'No' : 'Pending', 'Yes' : 'Solved'})
df
```

Out[72]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month	Crime Year	St
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	No	January	2020	Pen
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	No	January	2020	Pen
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	No	January	2020	Pen
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	Yes	January	2020	Sc
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	Yes	January	2020	Sc
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	No	August	2024	Pen
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	Yes	July	2024	Sc
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	No	August	2024	Pen
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	No	August	2024	Pen

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Case Closed	Crime Month	Crime Year	St
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	Yes	July	2024	Sc

40160 rows × 14 columns

In [73]:
```
df.drop(columns='Case Closed', inplace=True)
```

In [74]:
```
df
```

Out[74]:

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Crime Month	Crime Year	Case Status
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	January	2020	Pending
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	January	2020	Pending
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	January	2020	Pending
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	January	2020	Solved
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	January	2020	Solved
...	...	...	...	...	...	...	...	...	...	...	...	...	...
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	August	2024	Pending
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	July	2024	Solved
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	August	2024	Pending
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	August	2024	Pending

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Crime Month	Crime Year	Case Status
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	July	2024	Solved

40160 rows × 13 columns

In [75]:
```
bins = [0,12,19,35,50,100]
labels=['Child', 'Teen', 'Young Adult', 'Adult', 'Senior']

df['Age Group'] = pd.cut(df['Victim Age'], bins=bins, labels=labels, right=True)
df
```

Out[75]:

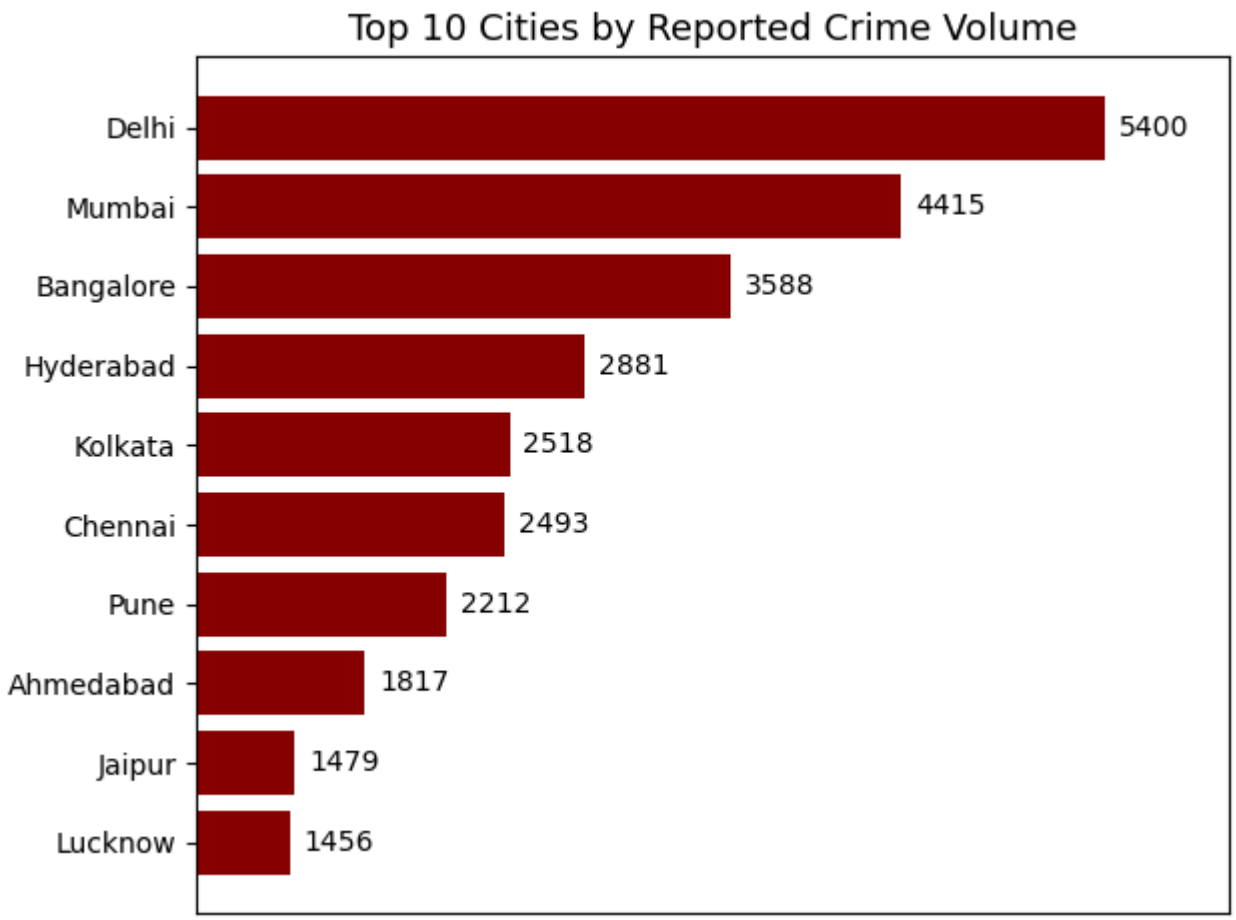
	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Crime Month	Crime Year	Case Status	Gr
0	1	2020-01-02 00:00:00	Ahmedabad	576	IDENTITY THEFT	16	Male	Blunt Object	Violent Crime	13	January	2020	Pending	-
1	2	2020-01-01 19:00:00	Chennai	128	HOMICIDE	37	Male	Poison	Unknown	9	January	2020	Pending	A
2	3	2020-01-02 05:00:00	Ludhiana	271	KIDNAPPING	48	Female	Blunt Object	Unknown	15	January	2020	Pending	A
3	4	2020-01-01 05:00:00	Pune	170	BURGLARY	49	Female	Firearm	Unknown	1	January	2020	Solved	A
4	5	2020-01-01 21:00:00	Pune	421	VANDALISM	30	Female	Unknown	Unknown	18	January	2020	Solved	Yo A
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40155	40156	2024-08-01 16:00:00	Kolkata	312	Unknown	78	Female	Firearm	Unknown	12	August	2024	Pending	Se
40156	40157	2024-07-31 14:00:00	Mumbai	300	ILLEGAL POSSESSION	75	Female	Unknown	Unknown	2	July	2024	Solved	Se
40157	40158	2024-08-02 03:00:00	Kanpur	423	VEHICLE - STOLEN	44	Male	Unknown	Violent Crime	6	August	2024	Pending	A
40158	40159	2024-08-01 19:00:00	Patna	311	SEXUAL ASSAULT	11	Male	Blunt Object	Violent Crime	1	August	2024	Pending	C

	Report Number	Date Reported	City	Crime Code	Crime Description	Victim Age	Victim Gender	Weapon Used	Crime Domain	Police Deployed	Crime Month	Crime Year	Case Status	Gr
40159	40160	2024-07-31 17:00:00	Delhi	193	DOMESTIC VIOLENCE	43	Female	Poison	Violent Crime	7	July	2024	Solved	A

40160 rows × 14 columns

5. Plotting Diagrams :

In [90]:
```
# 1. top 10 cities by crime
citytopn = df.groupby(by=['City']).agg({'Report Number' : 'count'}).sort_values(by='Report Number', ascending=False).head(10)
citytopn.sort_values(by='Report Number', ascending=False)
citytopn

bars = plt.barh(citytopn.index, citytopn['Report Number'], color = '#8B0000')
plt.title('Top 10 Cities by Reported Crime Volume', loc='center', fontdict={'size' : 13})

plt.bar_label(bars, labels=citytopn['Report Number'], label_type='edge', padding=5)


plt.gca().get_xaxis().set_visible(False)
plt.gca().invert_yaxis()
plt.xlim([1000,6000])
plt.tight_layout()

plt.show()
```

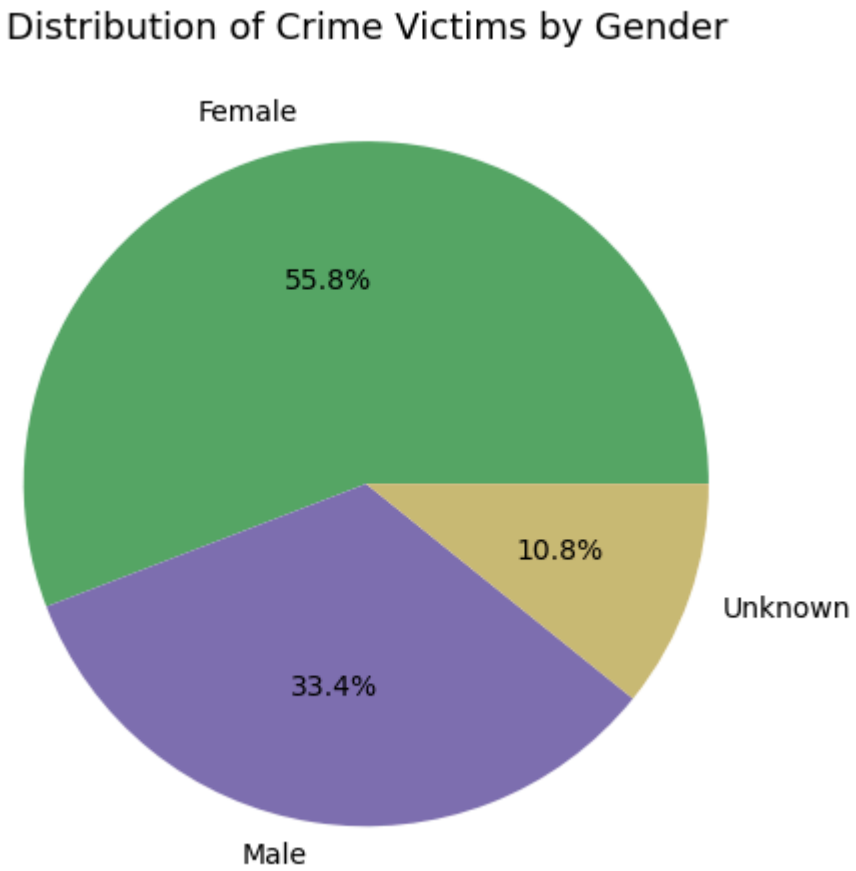


Insights :

- Delhi records the highest number of reported crimes, significantly outperforming other cities.
- Mumbai and Bangalore follow, indicating that metropolitan cities dominate crime volume.
- The top 3 cities contribute a disproportionately large share of total crimes, suggesting higher population density, urban stress, and reporting rates.

In [77]:
```
# 2. Gender distribution of victims

genderdist = df.groupby(by=['Victim Gender']).agg({'Report Number' : 'count'}).sort_values(by='Report Number', ascending=False
```

```
genderdist
colors = ['#55A868', '#8172B2', '#CCB974']

pie = plt.pie(genderdist['Report Number'], labels=genderdist['Victim Gender'], autopct='%1.1f%%', colors=colors)
plt.title('Distribution of Crime Victims by Gender', fontdict={'size' : 13})
plt.tight_layout()
plt.show()
```

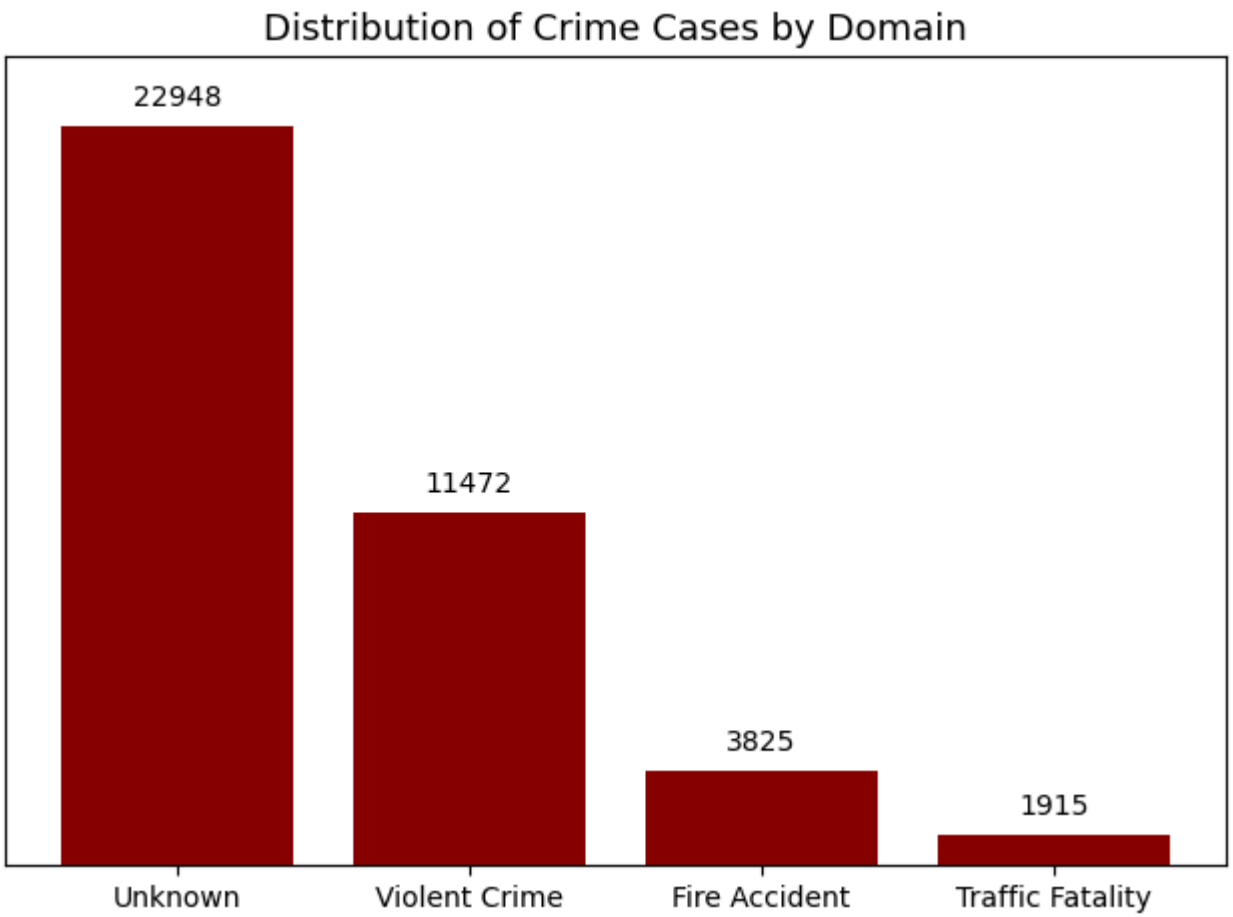


Insights :

- Female victims account for the majority (~55.8%) of reported cases.
- Male victims represent ~33.4% of cases.

- ~10.8% of records have unknown gender, indicating partial data gaps.

In [89]:
```
# 3. Crime Domain distribution

crimedomaindist = df.groupby(by=['Crime Domain']).agg({'Report Number' : 'count'}).sort_values(by='Report Number')
crimedomaindist

bar = plt.bar(crimedomaindist.index, height=crimedomaindist['Report Number'], color = '#8B0000')
plt.gca().get_yaxis().set_visible(False)
plt.bar_label(bar, labels=crimedomaindist['Report Number'], label_type='edge', padding=5)
plt.ylim([1000,25000])
plt.gca().invert_xaxis()
plt.title('Distribution of Crime Cases by Domain', fontdict={'size' : 13})
plt.tight_layout()

plt.show()
```

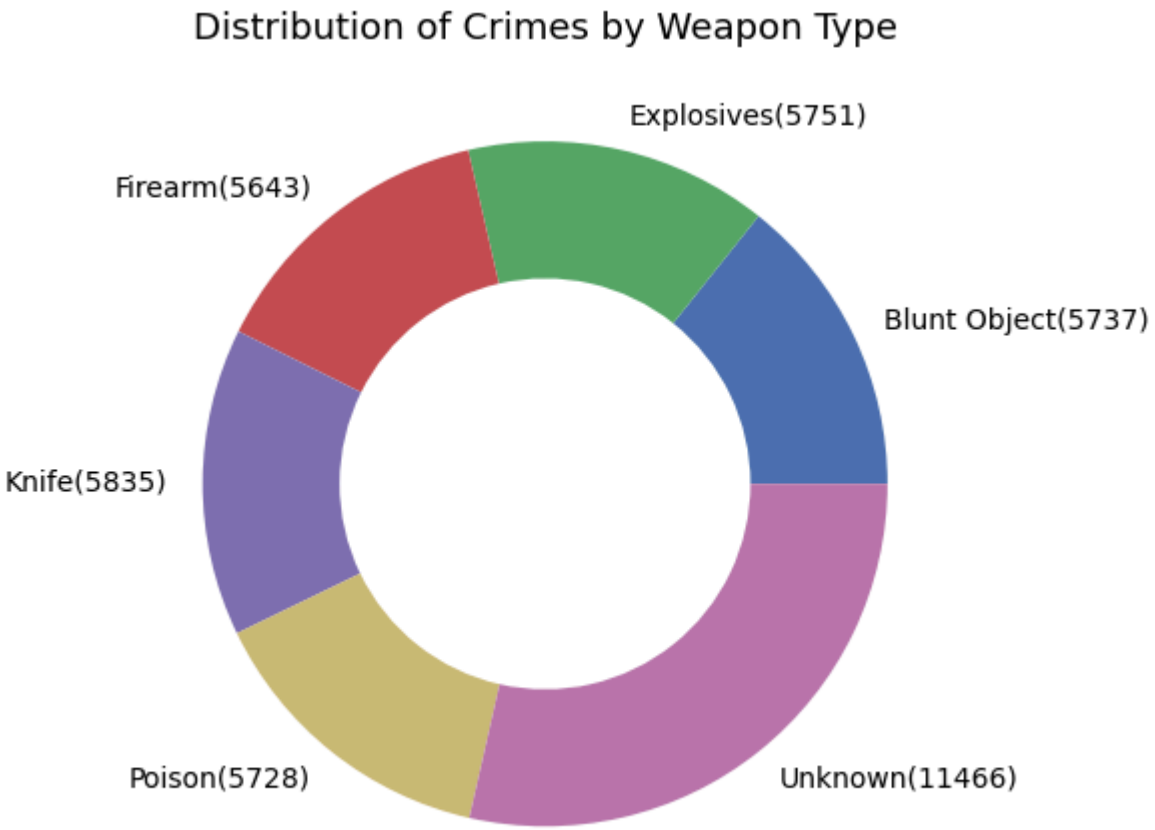


Insights :

- “Unknown” crime domain accounts for the largest share of cases (~22,948).
- Violent crimes are the most prominent clearly classified category (~11,472 cases).
- Fire accidents (~3,825) and traffic fatalities (~1,915) contribute a much smaller proportion of total incidents.

In [88]:
```
# 4. Weapon Used in Crime

weaponused = df.groupby(by=['Weapon Used'])['Report Number'].count().reset_index()
weaponused
```

```
colors = ['#4C72B0', '#55A868', '#C44E52', '#8172B2', '#CCB974', "#B976AB"]
labels = (weaponused['Weapon Used']  + '(' + weaponused['Report Number'].astype(str) + ')')

plt.pie(weaponused['Report Number'], labels=labels, wedgeprops={'width' : 0.4}, colors=colors)
plt.title('Distribution of Crimes by Weapon Type', fontdict={'size' : 13})
plt.tight_layout()
plt.show()
```

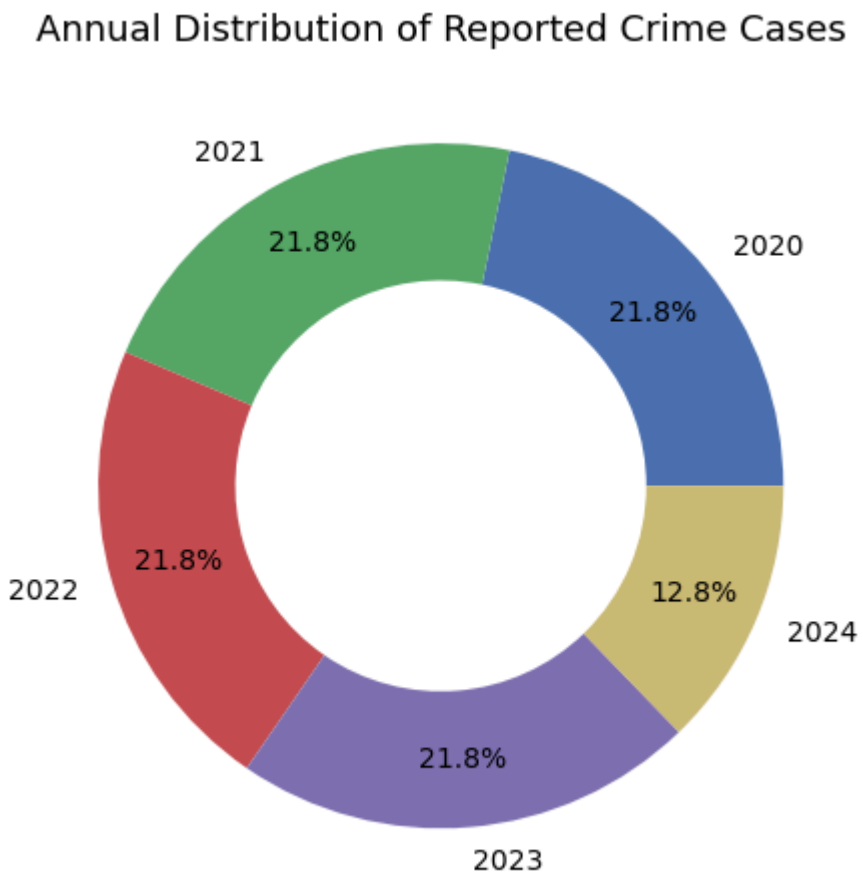


Insights :

- A large number of crimes involve Unknown weapon or knives.
- Firearms are less frequent overall.

- The presence of weaponless crimes suggests that opportunistic and non-premeditated crimes form a significant share of incidents.

In [87]:
```
# 5. Crime cases per year

crimeXyear = df.groupby(by=df['Crime Year']).agg({'Report Number' : 'count'}).reset_index().rename(columns={'Report Number' :
crimeXyear

colors = ['#4C72B0', '#55A868', '#C44E52', '#8172B2', '#CCB974']

plt.pie(crimeXyear['No. of Cases'], labels=crimeXyear['Crime Year'], wedgeprops={'width' : 0.4}, autopct='%1.1f%%', pctdistanc
plt.title('Annual Distribution of Reported Crime Cases', fontdict={'size' : 13})
plt.tight_layout()
plt.show()
```

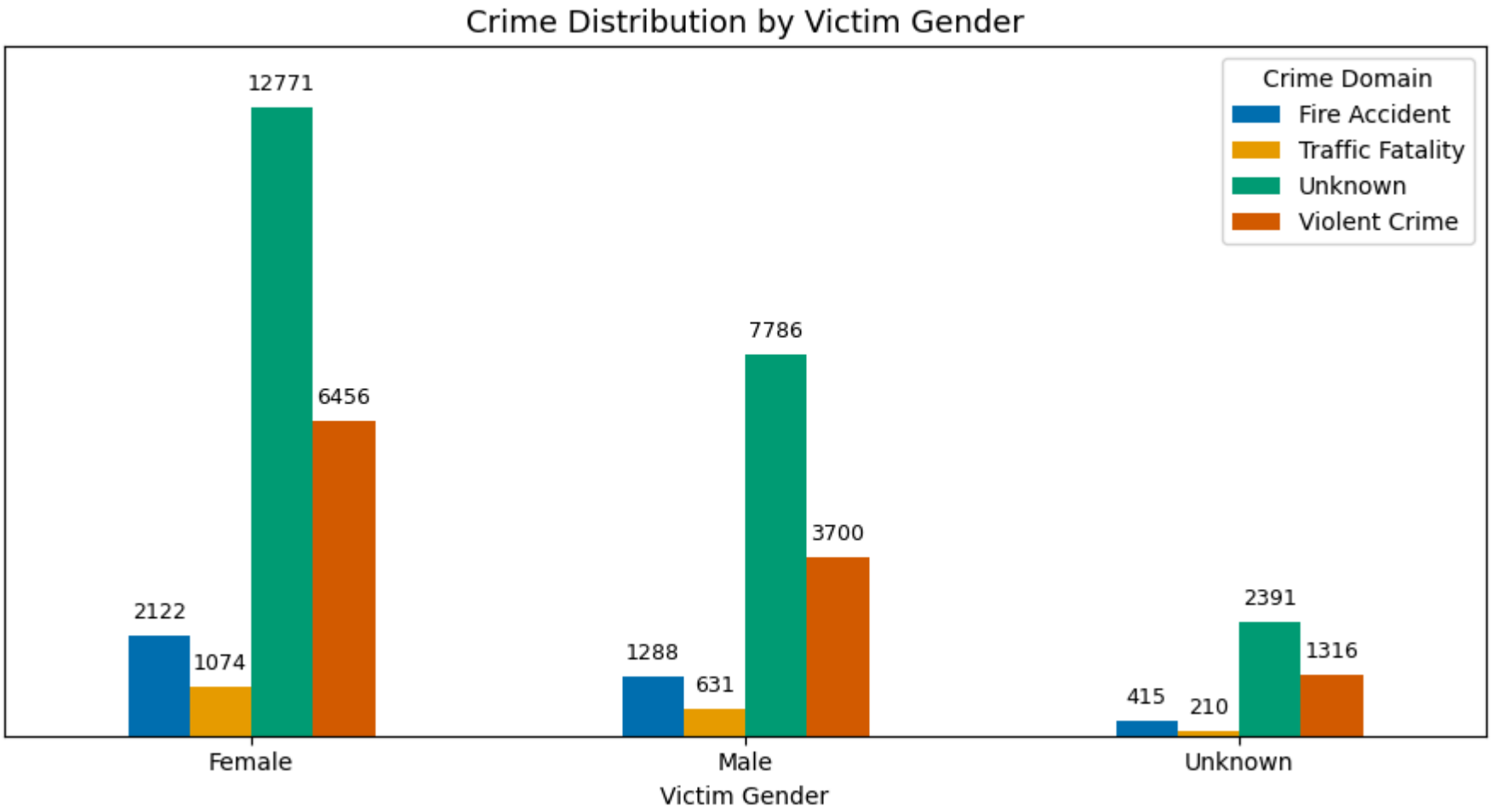


Insights :

- Crime distribution remains largely stable between 2020 and 2023, with each year contributing roughly ~21–22% of total cases.
- This indicates no extreme year-on-year volatility during this period.

In [86]:
```
# 6. Victim Gender vs Crime Type

victimXgender = df.groupby(by=['Victim Gender', 'Crime Domain']).agg({'Report Number' : 'count'}).unstack()
victimXgender
victimXgender.columns = victimXgender.columns.droplevel(0)
```

```
ax = victimXgender.plot(kind='bar',figsize=(9,5),stacked=False, color = ['#0072B2', '#E69F00', '#009E73', '#D55E00'])

for container in ax.containers:
    ax.bar_label(container, fontsize=9, padding=5)


plt.gca().get_yaxis().set_visible(False)
plt.xlabel('Victim Gender')
plt.ylabel('Number of Cases')
plt.title('Crime Distribution by Victim Gender', fontdict={'size' : 13})
plt.legend(title='Crime Domain', loc='best')
plt.xticks(rotation=0)
plt.ylim([100,14000])
plt.tight_layout()
plt.show()
```

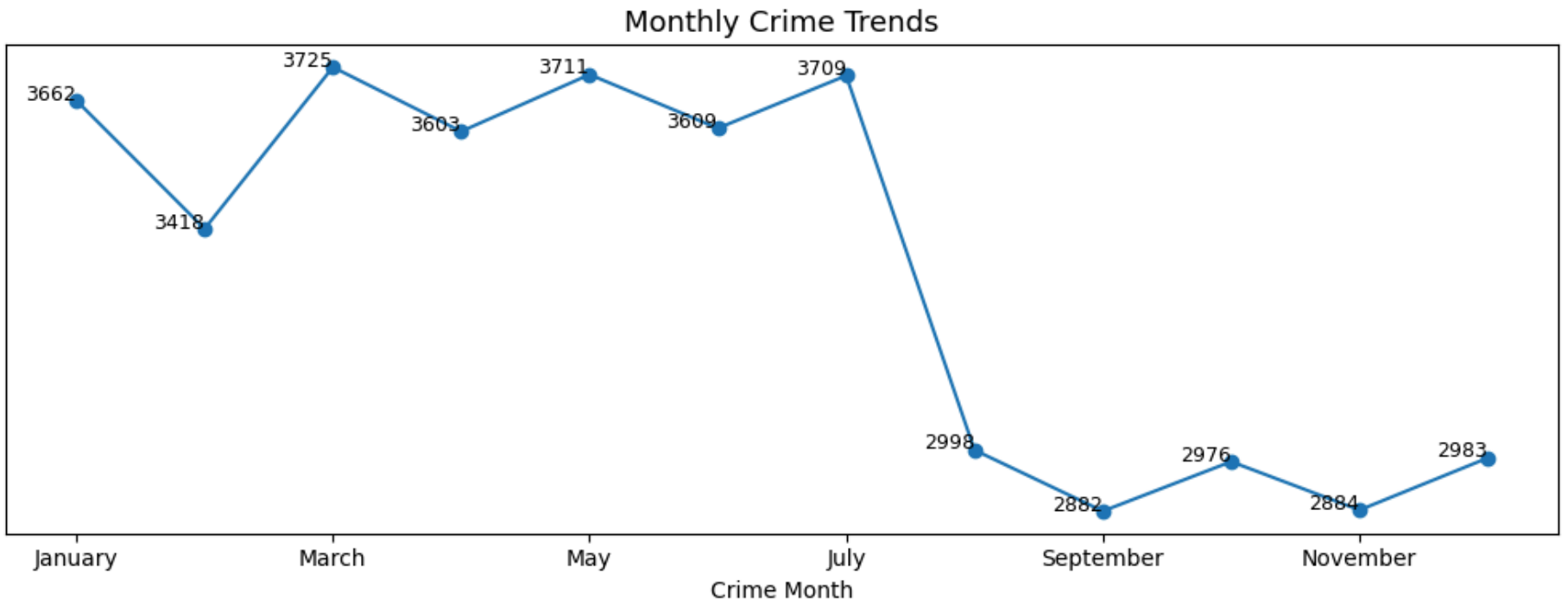


Insights :

- Female victims report the highest number of cases across all crime domains, particularly in Violent Crime and Unknown categories.
- Male victims consistently report fewer cases than females but follow a similar pattern across crime domains.
- The Unknown gender category contributes minimally, indicating relatively good data completeness.

In [92]:
```
# 7. Crimes By Month

crimesXmonths = df.groupby(by=['Crime Month'])['Report Number'].count().reset_index()
```

```
crimesXmonths
month_order = ['January', 'February', 'March', 'April', 'May', 'June','July', 'August', 'September', 'October', 'November', 'D
crimesXmonths['Crime Month'] =pd.Categorical(crimesXmonths['Crime Month'],categories=month_order,ordered=True)
crimesXmonths = crimesXmonths.sort_values('Crime Month')

plt.figure(figsize=(10,4))
plt.plot(crimesXmonths['Crime Month'], crimesXmonths['Report Number'], marker='o')
plt.xlabel('Crime Month')
plt.title('Monthly Crime Trends', fontdict={'size' : 13})
plt.gca().get_yaxis().set_visible(False)
plt.tight_layout()


for i in range(len(crimesXmonths)):
    plt.text(crimesXmonths['Crime Month'][i],crimesXmonths['Report Number'][i] + 1,crimesXmonths['Report Number'][i],ha='right



plt.xticks(crimesXmonths['Crime Month'][::2])
plt.show()
```

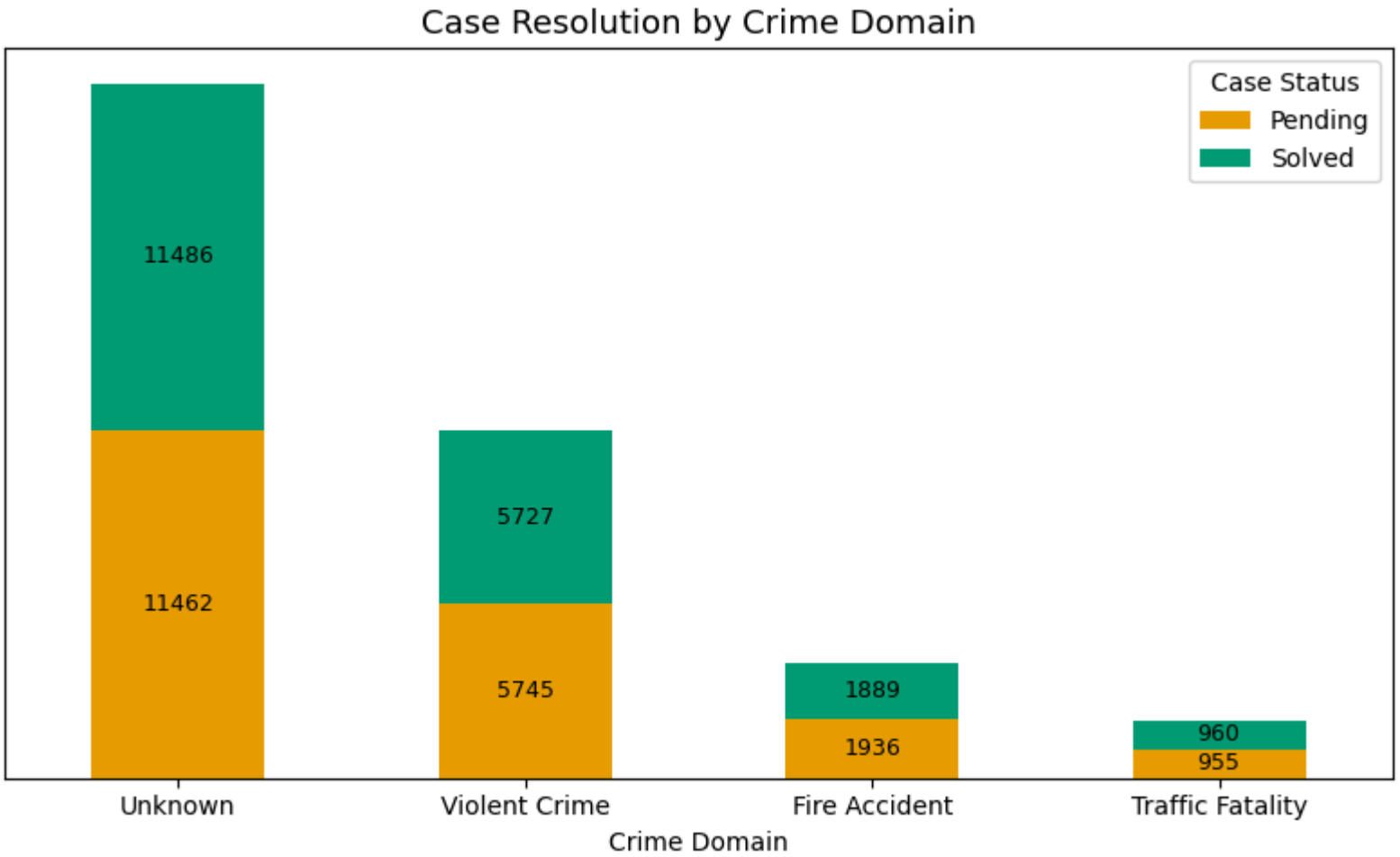


Insights :

- Crime incidents remain consistently high during the first half of the year (January–July).
- A sharp decline is observed after July, reaching the lowest levels around September–November.
- This suggests a seasonal pattern in crime occurrences.

In [83]:
```
# 8. Pending vs Solved cases by crime domain

penXsol = df.groupby(by=['Case Status', 'Crime Domain' ])['Report Number'].count().reset_index().rename(columns={'Report Numbe
penXsol

pivot_df = penXsol.pivot(index='Crime Domain', columns='Case Status', values='No. of Cases')
pivot_df = pivot_df.sort_values(by=pivot_df.columns.tolist(), ascending=False)

fig, ax = plt.subplots(figsize=(8, 5))
pivot_df.plot(kind='bar', stacked=True, ax=ax, color = ['#E69F00', '#009E73'])
ax.set_title('Case Resolution by Crime Domain', fontdict={'size' : 13})
```

```
ax.set_xlabel('Crime Domain')
ax.legend(title='Case Status')

for container in ax.containers:
    ax.bar_label(container, label_type='center', fontsize=9)

plt.xticks(rotation=360, ha='center')
plt.gca().get_yaxis().set_visible(False)
plt.tight_layout()
plt.show()
```

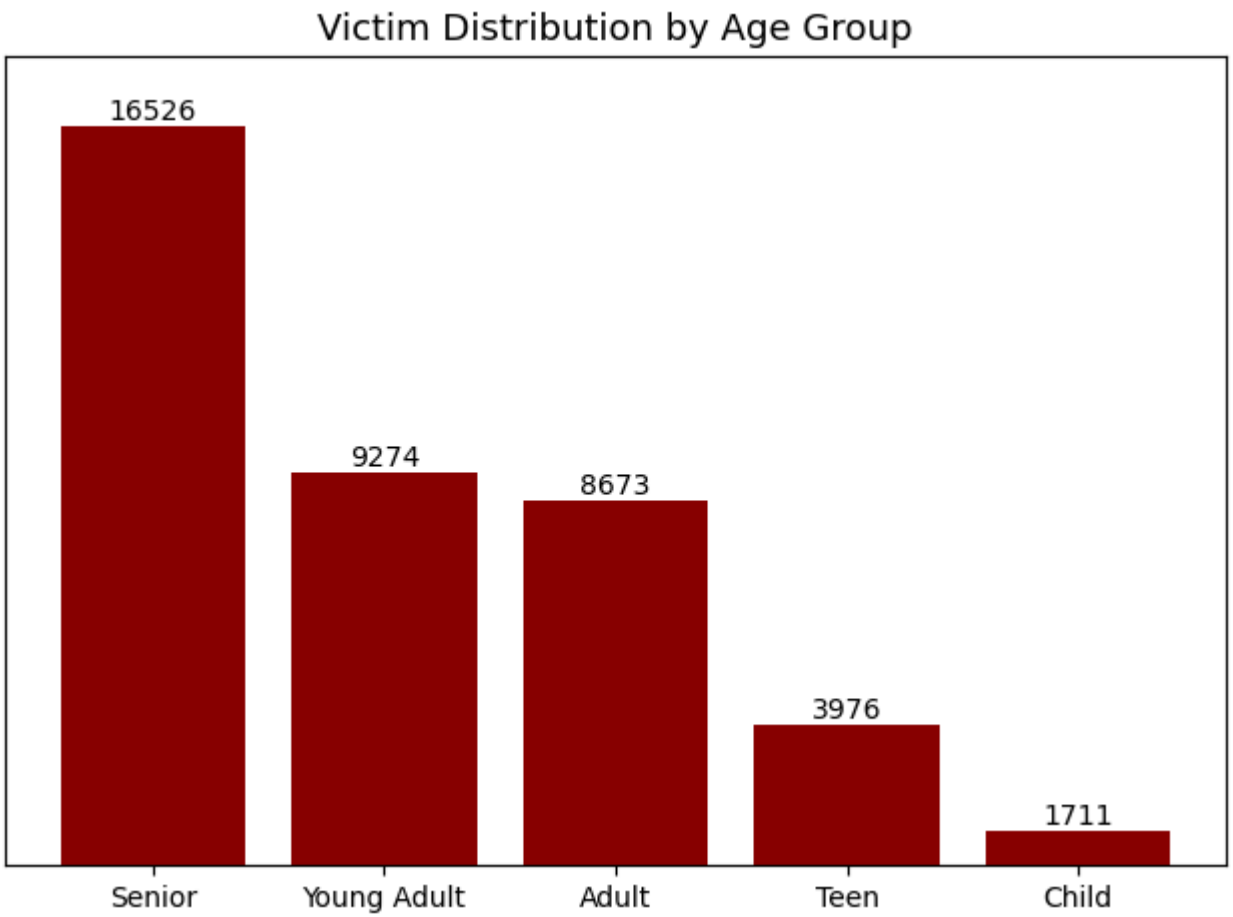


Insights :

- Across all crime domains, a significant portion of cases remain pending, highlighting systemic delays in case resolution.
- The gap between pending and solved cases varies by crime type, indicating differences in investigation complexity and priority.

In [85]:
```
# 9. Victims by Agegroup

grupXcrime = df.groupby(by=['Age Group'])['Report Number'].count().reset_index().rename(columns={'Report Number' : 'No. of Cas
grupXcrime

bars = plt.bar(grupXcrime['Age Group'], grupXcrime['No. of Cases'], color = '#8B0000')
plt.ylim([1000,18000])

plt.bar_label(bars, labels=grupXcrime['No. of Cases'], label_type='edge')
plt.title('Victim Distribution by Age Group', fontdict={'size' : 13})
plt.gca().get_yaxis().set_visible(False)
plt.gca().invert_xaxis()
plt.tight_layout()

plt.show()
```

```
C:\Users\Admin\AppData\Local\Temp\ipykernel_11344\3988983003.py:3: FutureWarning: The default of observed=False is deprecated a
nd will be changed to True in a future version of pandas. Pass observed=False to retain current behavior or observed=True to ad
opt the future default and silence this warning.
  grupXcrime = df.groupby(by=['Age Group'])['Report Number'].count().reset_index().rename(columns={'Report Number' : 'No. of Ca
ses'}).sort_values(by='No. of Cases', ascending=True)
```



Insights :

- Senior citizens represent the largest victim group, accounting for the highest number of reported cases.
- Crime impact is not evenly distributed across age groups, indicating varying vulnerability levels.

6. Limitations :

- Analysis is based only on reported crimes
- Lack of geographic and socioeconomic variables

- No multi-year data to assess long-term trends

7. Key Insights & Conclusion :

- Crime incidents vary significantly by month, indicating seasonal trends
- Certain age groups and genders are disproportionately affected by specific crime types
- Case resolution rates differ across crime domains, highlighting operational gaps
- Findings can support targeted prevention strategies and resource allocation

In [93]:
```
df.to_csv("crime_data_cleaned.csv", index=False)
```

In [ ]:
```

```