In [1]:
```
from pathlib import Path
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import scipy.stats
```

In [24]:
```
CURRENT = Path(r"C:\Users\ABHIVARUN\DATA\data").parent
DATA = CURRENT / "data"
```

In [25]:
```
basic = pd.read_csv(DATA / "basic.csv")
```

In [26]:
```
basic = pd.read_csv(
    DATA / "basic.csv",
    converters={"NetID": str.lower, "Email Address": str.lower},
    usecols=["Section", "Email Address", "NetID"],
    index_col="NetID",
)
```

In [27]:
```
basic.head()
```

Out[27]:

| NetID | Email Address | Section |
|---|---|---|
| **wxb12345** | woody.barrera_jr@univ.edu | 1 |
| **mxl12345** | malaika.lambert@univ.edu | 2 |
| **txj12345** | traci.joyce@univ.edu | 1 |
| **jgf12345** | john.g.2.flower@univ.edu | 3 |
| **smj00936** | stacy.johnson@univ.edu | 2 |

In [19]:
```
hw_grades = pd.read_csv(DATA / "hw_grades.csv")
```

In [21]:
```
hw_grades = pd.read_csv(
    DATA / "hw_grades.csv",
    converters={"SID": str.lower},
    usecols=lambda x: "Submission" not in x,
    index_col="SID",
)
```

In [22]:
```
hw_grades.head()
```

Out[22]:

| SID | First Name | Last Name | Homework 1 | Homework 1 - Max Points | Homework 2 | Homework 2 - Max Points | Homework 3 | Ho |
|---|---|---|---|---|---|---|---|---|
| **axl60952** | Aaron | Lester | 68.0 | 80 | 74 | 80 | 77 | |
| **amc28428** | Adam | Cooper | 80.0 | 80 | 78 | 80 | 78 | |
| **axc64717** | Alec | Curry | 69.0 | 80 | 76 | 80 | 66 | |
| **akr14831** | Alexander | Rodriguez | 50.0 | 80 | 54 | 80 | 74 | |
| **axd11293** | Amber | Daniels | 54.0 | 80 | 57 | 80 | 77 | |

5 rows × 28 columns

In [32]:
```
quiz_grades = pd.DataFrame()
for file_path in DATA.glob("*-quiz.csv"):
    quiz_name = " ".join(file_path.stem.title().split("_")[:2])
    quiz = pd.read_csv(
        file_path,
        index_col=["Email"],
        usecols=["Email", "Grade"],
    ).rename(columns={"Grade": quiz_name})
    quiz_grades = pd.concat([quiz_grades, quiz], axis=1)
```

In [33]:
```
quiz_grades.head()
```

Out[33]:

| Email | 1-Quiz | 2-Quiz | 3-Quiz | 4-Quiz | 5-Quiz |
|---|---|---|---|---|---|
| **richard.bennett@univ.edu** | 10 | 6 | 9 | 8 | 10 |
| **timothy.parker@univ.edu** | 9 | 14 | 13 | 14 | 10 |
| **carol.reyes@univ.edu** | 5 | 15 | 8 | 14 | 6 |
| **brooke.powers@univ.edu** | 6 | 10 | 17 | 10 | 8 |
| **michael.taylor@univ.edu** | 5 | 15 | 13 | 12 | 5 |

In [35]:
```
total_data = pd.merge(
    basic,
    hw_grades,
    left_index=True,
    right_index=True,
)
total_data = pd.merge(
    total_data, quiz_grades, left_on="Email Address", right_index=True
)
total_data = total_data.fillna(0)
```

In [36]:
```
print(total_data)
```

```
                      Email Address  Section First Name Last Name  Homework 1  \
wxb12345  woody.barrera_jr@univ.edu        1      Woody   Barrera        55.0
mxl12345   malaika.lambert@univ.edu        2    Malaika   Lambert        63.0
txj12345       traci.joyce@univ.edu        1      Traci     Joyce         0.0
jgf12345   john.g.2.flower@univ.edu        3      Gregg    Flower        69.0
smj00936     stacy.johnson@univ.edu        2      Stacy   Johnson        74.0
...                             ...      ...        ...       ...         ...
pmj37756      paul.johnson@univ.edu        3       Paul   Johnson        73.0
dsl24347      danielle.lee@univ.edu        3   Danielle       Lee        69.0
nxe44872    nicole.edwards@univ.edu        3     Nicole   Edwards        62.0
bxr62103      bailey.reyes@univ.edu        2     Bailey     Reyes        53.0
jxw53347       joyce.walls@univ.edu        1      Joyce     Walls        59.0

          Homework 1 - Max Points  Homework 2  Homework 2 - Max Points  \
wxb12345                       80          62                       80
mxl12345                       80          57                       80
txj12345                       80          77                       80
jgf12345                       80          52                       80
smj00936                       80          55                       80
...                           ...         ...                      ...
pmj37756                       80          50                       80
dsl24347                       80          51                       80
nxe44872                       80          76                       80
bxr62103                       80          50                       80
jxw53347                       80          77                       80

          Homework 3  Homework 3 - Max Points  ...  Exam 1 - Max Points  \
wxb12345          73                       80  ...                  100
mxl12345          78                       80  ...                  100
txj12345          58                       80  ...                  100
jgf12345          64                       80  ...                  100
smj00936          60                       80  ...                  100
...              ...                      ...  ...                  ...
pmj37756          55                       80  ...                  100
dsl24347          70                       80  ...                  100
nxe44872          62                       80  ...                  100
bxr62103          55                       80  ...                  100
jxw53347          61                       80  ...                  100

          Exam 2  Exam 2 - Max Points  Exam 3  Exam 3 - Max Points  1-Quiz  \
wxb12345      62                  100      90                  100       4
mxl12345      91                  100      93                  100       8
txj12345      84                  100      64                  100       8
jgf12345      83                  100      77                  100       8
smj00936      80                  100      86                  100       6
...          ...                  ...     ...                  ...     ...
pmj37756      80                  100      94                  100      10
dsl24347      70                  100      90                  100       7
nxe44872      63                  100      65                  100      10
bxr62103      72                  100      71                  100      10
jxw53347      73                  100      91                  100      10

          2-Quiz  3-Quiz  4-Quiz  5-Quiz
wxb12345      10      11       7      10
mxl12345      10      10      13       6
txj12345       6      14       9       4
jgf12345       8       8      13       5
smj00936      14      11       7       7
...          ...     ...     ...     ...
pmj37756      14       9      11      10
dsl24347      14      10       5       7
nxe44872      12       9      12      10
bxr62103      15      17       6       7
jxw53347       6       9       7      12
```

```
[150 rows x 35 columns]
```

In [37]:

```
n_exams = 3
for n in range(1, n_exams + 1):
    total_data[f"Exam {n} Score"] = (
        total_data[f"Exam {n}"] / total_data[f"Exam {n} - Max Points"]
    )
homework_scores = total_data.filter(regex=r"^Homework \d\d?$", axis=1)
homework_max_points = total_data.filter(regex=r"^Homework \d\d? -", axis=1)
sum_of_hw_scores = homework_scores.sum(axis=1)
sum_of_hw_max = homework_max_points.sum(axis=1)
total_data["Total Homework"] = sum_of_hw_scores / sum_of_hw_max
hw_max_renamed = homework_max_points.set_axis(homework_scores.columns, axis=1)
average_hw_scores = (homework_scores / hw_max_renamed).sum(axis=1)
total_data["Average Homework"] = average_hw_scores / homework_scores.shape[1]
total_data["Homework Score"] = total_data[
    ["Total Homework", "Average Homework"]
].max(axis=1)
quiz_scores = total_data.filter(regex=r"^Quiz \d$", axis=1)
quiz_max_points = pd.Series(
    {"Quiz 1": 11, "Quiz 2": 15, "Quiz 3": 17, "Quiz 4": 14, "Quiz 5": 12}
)
sum_of_quiz_scores = quiz_scores.sum(axis=1)
sum_of_quiz_max = quiz_max_points.sum()
total_data["Total Quizzes"] = sum_of_quiz_scores / sum_of_quiz_max
average_quiz_scores = (quiz_scores / quiz_max_points).sum(axis=1)
total_data["Average Quizzes"] = average_quiz_scores / quiz_scores.shape[1]
total_data["Quiz Score"] = total_data[
    ["Total Quizzes", "Average Quizzes"]
].max(axis=1)
weightings = pd.Series(
    {
        "Exam 1 Score": 0.05,
        "Exam 2 Score": 0.1,
        "Exam 3 Score": 0.15,
        "Quiz Score": 0.30,
        "Homework Score": 0.4,
    }
)

total_data["Final Score"] = (total_data[weightings.index] * weightings).sum(
    axis=1
)
total_data["Ceiling Score"] = np.ceil(total_data["Final Score"] * 100)

grades = {
    90: "A",
    80: "B",
    70: "C",
    60: "D",
    0: "F",
}

def grade_mapping(value):
    """Map numerical grade to letter grade."""
    for key, letter in grades.items():
        if value >= key:
            return letter
letter_grades = total_data["Ceiling Score"].map(grade_mapping)
total_data["Final Grade"] = pd.Categorical(
    letter_grades, categories=grades.values(), ordered=True
)
```

In [38]:
```
print(letter_grades)
```

```
wxb12345    F
mxl12345    D
txj12345    F
jgf12345    F
smj00936    F
            ..
pmj37756    F
dsl24347    F
nxe44872    F
bxr62103    F
jxw53347    F
Name: Ceiling Score, Length: 150, dtype: object
```

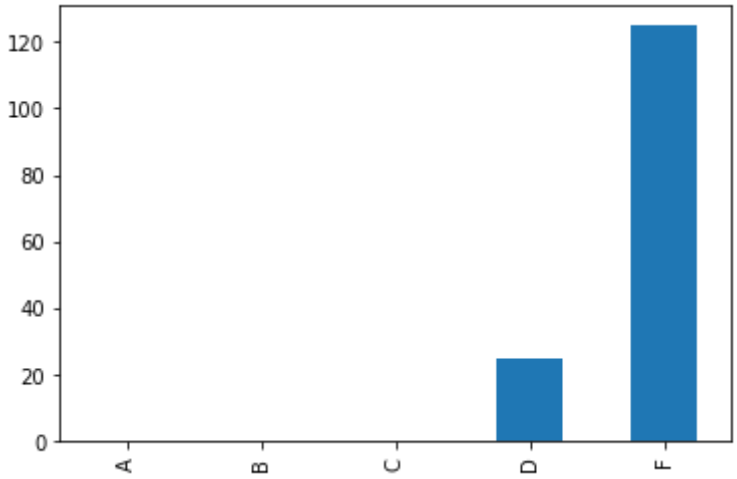
In [40]:
```
for section, table in final_data.groupby("Section"):
    section_file = DATA / f"grades of section {section}.csv"
    num_students = table.shape[0]
    print(
        f"there are {num_students} students in section {section} saved to "
        f"file {section_file}."
    )
    table.sort_values(by=["Last Name", "First Name"]).to_csv(section_file)
```

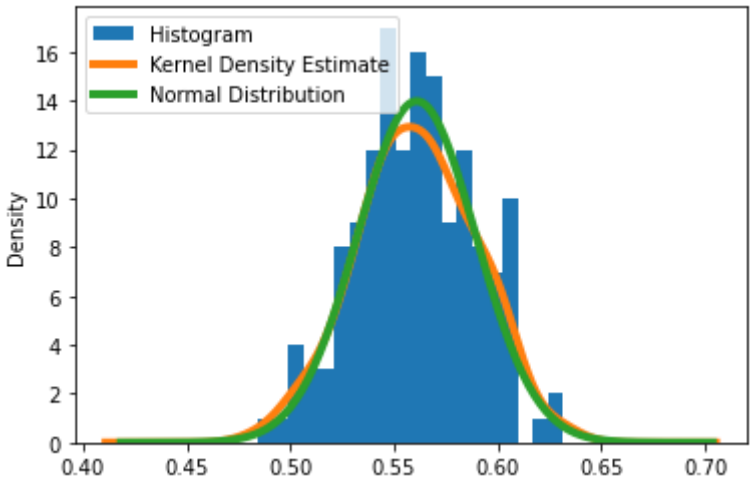
```
there are 56 students in section 1 saved to file C:\Users\ABHIVARUN\DATA\data\grad
es of section 1.csv.
there are 51 students in section 2 saved to file C:\Users\ABHIVARUN\DATA\data\grad
es of section 2.csv.
there are 43 students in section 3 saved to file C:\Users\ABHIVARUN\DATA\data\grad
es of section 3.csv.
```

In [49]:
```
total_grade_counts = total_data["Final Grade"].value_counts().sort_index()
total_grade_counts.plot.bar()
plt.show()

total_data["Final Score"].plot.hist(bins=20, label="Histogram")
total_data["Final Score"].plot.density(
    linewidth=4, label="Kernel Density Estimate"
)

total_mean = total_data["Final Score"].mean()
total_std = total_data["Final Score"].std()
x = np.linspace(total_mean - 5 * total_std, total_mean + 5 * total_std, 200)
normal_dist = scipy.stats.norm.pdf(x, loc=total_mean, scale=total_std)
plt.plot(x, normal_dist, label="Normal Distribution", linewidth=4)
plt.legend()
plt.show()
```




Histogram
Kernel Density Estimate
Normal Distribution
Density
0
2
4
6
8
10
12
14
16
0.40
0.45
0.50
0.55
0.60
0.65
0.70

In [ ]: