In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```
data = pd.read_csv('/content/3_Spreadsheet_Output.csv')
```

In [3]:
```
data
```

Out[3]:

	Iteration	Program	Size	Current Time	Running Average
0	1	./seq	64	0.000013	0.000013
1	2	./seq	64	0.000012	0.000013
2	3	./seq	64	0.000013	0.000013
3	4	./seq	64	0.000013	0.000013
4	5	./seq	64	0.000012	0.000013
...	...	...	...	...	...
495	6	./mpi_tiling	32768	3.011549	3.015613
496	7	./mpi_tiling	32768	2.998080	3.013108
497	8	./mpi_tiling	32768	3.071790	3.020443
498	9	./mpi_tiling	32768	3.024593	3.020904
499	10	./mpi_tiling	32768	2.996589	3.018473

500 rows × 5 columns

In [4]:
```
sizes = [64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768]

data_dict = {}

for size in sizes:
    index = sizes.index(size) * 10

    data_temp = {
        'Program': [data.iloc[index, 1], data.iloc[index + 100, 1], data.iloc[index +
        'Size': [data.iloc[index, 2], data.iloc[index + 100, 2], data.iloc[index + 200
        'Running Average': [data.iloc[index, 4], data.iloc[index + 100, 4], data.iloc[
    }

    data_temp_df = pd.DataFrame(data_temp)

    data_dict[f"data_{size}"] = data_temp_df

for key, df in data_dict.items():
    print(f"\n\t------ Dataset {key} ------\n\n", df)
```

```
        ------ Dataset data_64 ------

          Program  Size  Running Average
0          ./seq    64         0.000013
1          ./omp    64         0.000094
2   ./omp_tiling    64         0.000093
3          ./mpi    64         0.000022
4   ./mpi_tiling    64         0.000028

        ------ Dataset data_128 ------

          Program  Size  Running Average
0          ./seq   128         0.000049
1          ./omp   128         0.000108
2   ./omp_tiling   128         0.000151
3          ./mpi   128         0.000061
4   ./mpi_tiling   128         0.000068

        ------ Dataset data_256 ------

          Program  Size  Running Average
0          ./seq   256         0.000180
1          ./omp   256         0.001250
2   ./omp_tiling   256         0.000171
3          ./mpi   256         0.000240
4   ./mpi_tiling   256         0.000248

        ------ Dataset data_512 ------

          Program  Size  Running Average
0          ./seq   512         0.000717
1          ./omp   512         0.001325
2   ./omp_tiling   512         0.010853
3          ./mpi   512         0.000862
4   ./mpi_tiling   512         0.000769

        ------ Dataset data_1024 ------

          Program  Size  Running Average
0          ./seq  1024         0.002922
1          ./omp  1024         0.001588
2   ./omp_tiling  1024         0.001914
3          ./mpi  1024         0.002903
4   ./mpi_tiling  1024         0.003283

        ------ Dataset data_2048 ------

          Program  Size  Running Average
0          ./seq  2048         0.011565
1          ./omp  2048         0.006122
2   ./omp_tiling  2048         0.006176
3          ./mpi  2048         0.011547
4   ./mpi_tiling  2048         0.011597

        ------ Dataset data_4096 ------

          Program  Size  Running Average
0          ./seq  4096         0.046239
1          ./omp  4096         0.024099
2   ./omp_tiling  4096         0.023094
```

```
3          ./mpi  4096         0.046312
4   ./mpi_tiling  4096         0.048790

        ------ Dataset data_8192 ------

          Program  Size  Running Average
0          ./seq  8192         0.188282
1          ./omp  8192         0.103285
2   ./omp_tiling  8192         0.092426
3          ./mpi  8192         0.186150
4   ./mpi_tiling  8192         0.191338

        ------ Dataset data_16384 ------

          Program   Size  Running Average
0          ./seq  16384         0.753165
1          ./omp  16384         0.388487
2   ./omp_tiling  16384         0.389600
3          ./mpi  16384         0.758808
4   ./mpi_tiling  16384         0.755649

        ------ Dataset data_32768 ------

          Program   Size  Running Average
0          ./seq  32768         3.113525
1          ./omp  32768         1.555697
2   ./omp_tiling  32768         1.520747
3          ./mpi  32768         3.012235
4   ./mpi_tiling  32768         3.016500
```

For input size = 64

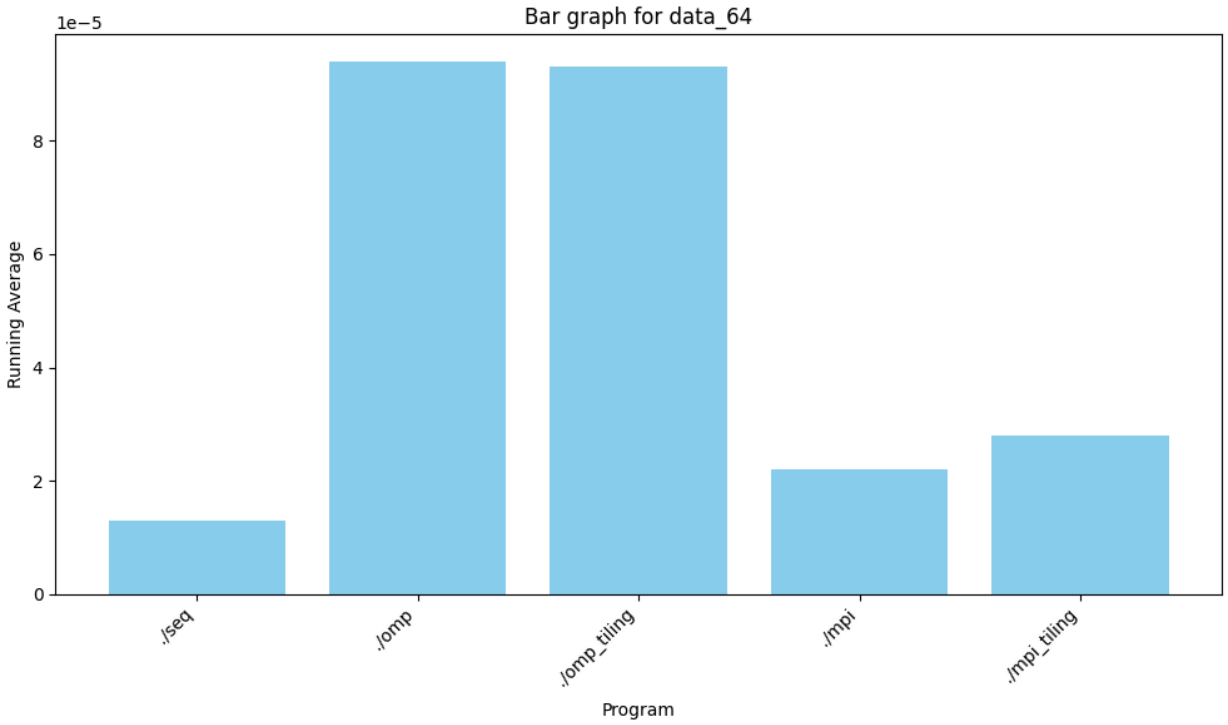
In [5]:
```
x_values = data_dict['data_64']['Program']
y_values = data_dict['data_64']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_64')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 128

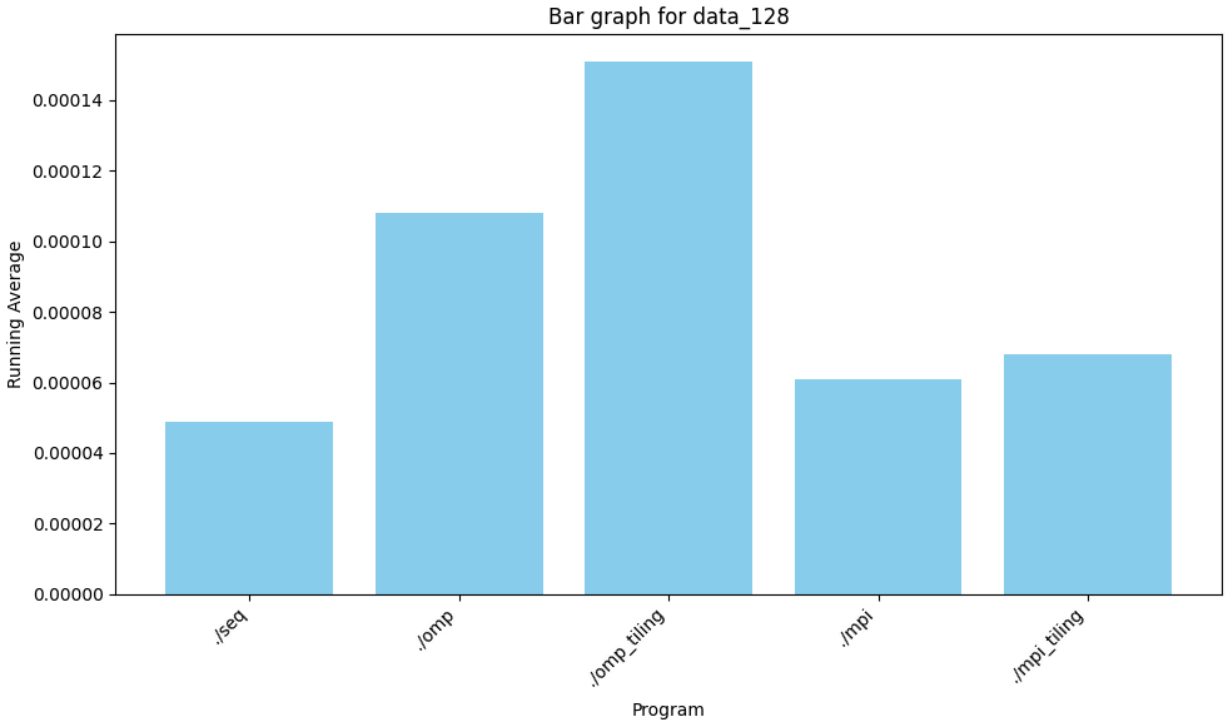
In [6]:
```
x_values = data_dict['data_128']['Program']
y_values = data_dict['data_128']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_128')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 256

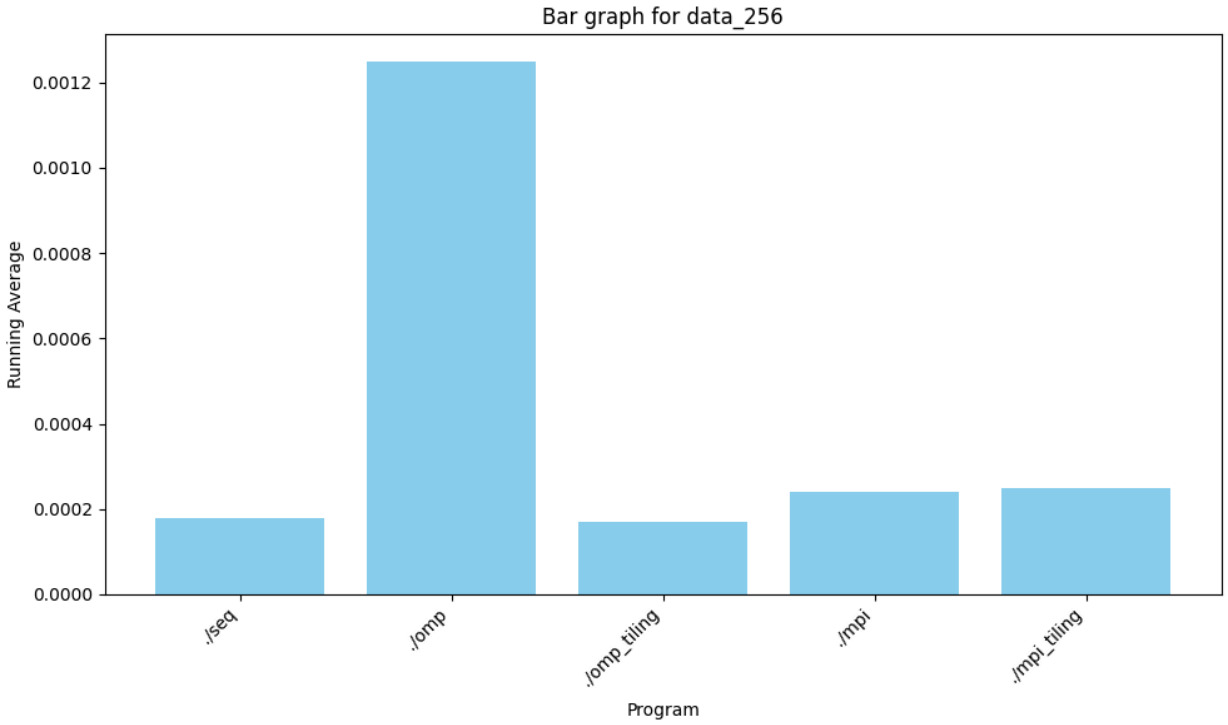
In [7]:
```
x_values = data_dict['data_256']['Program']
y_values = data_dict['data_256']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_256')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 1024

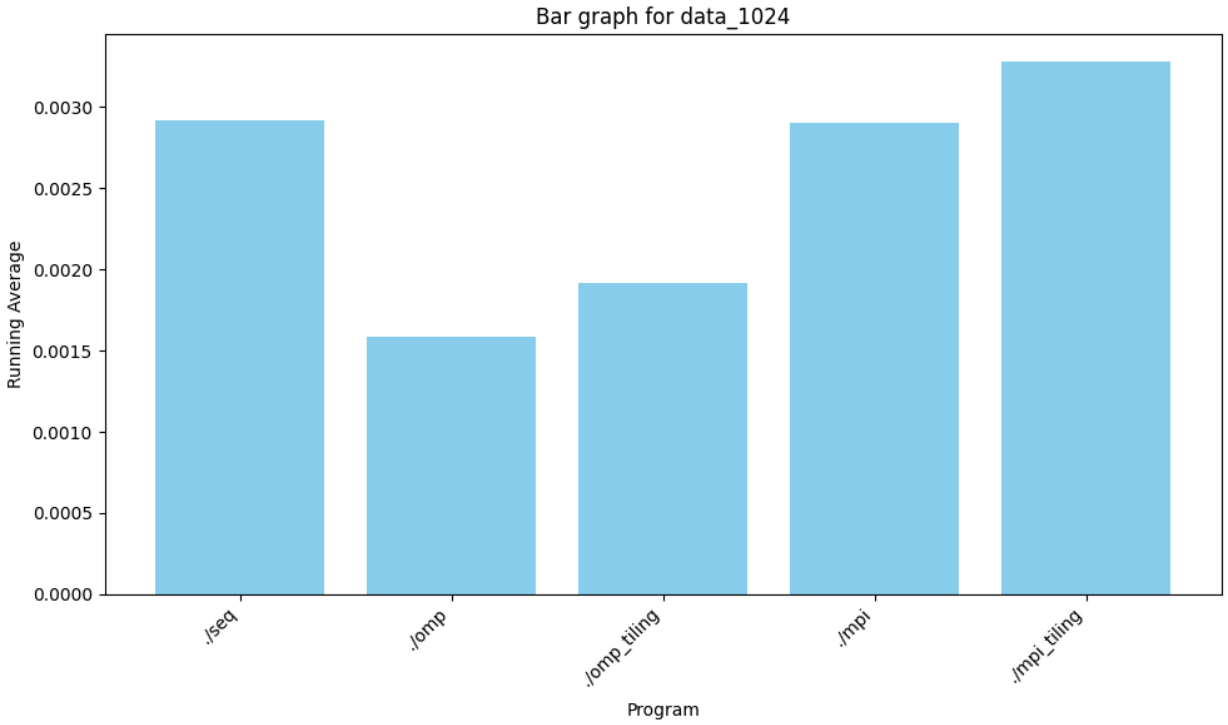
In [8]:
```
x_values = data_dict['data_1024']['Program']
y_values = data_dict['data_1024']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_1024')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 2048

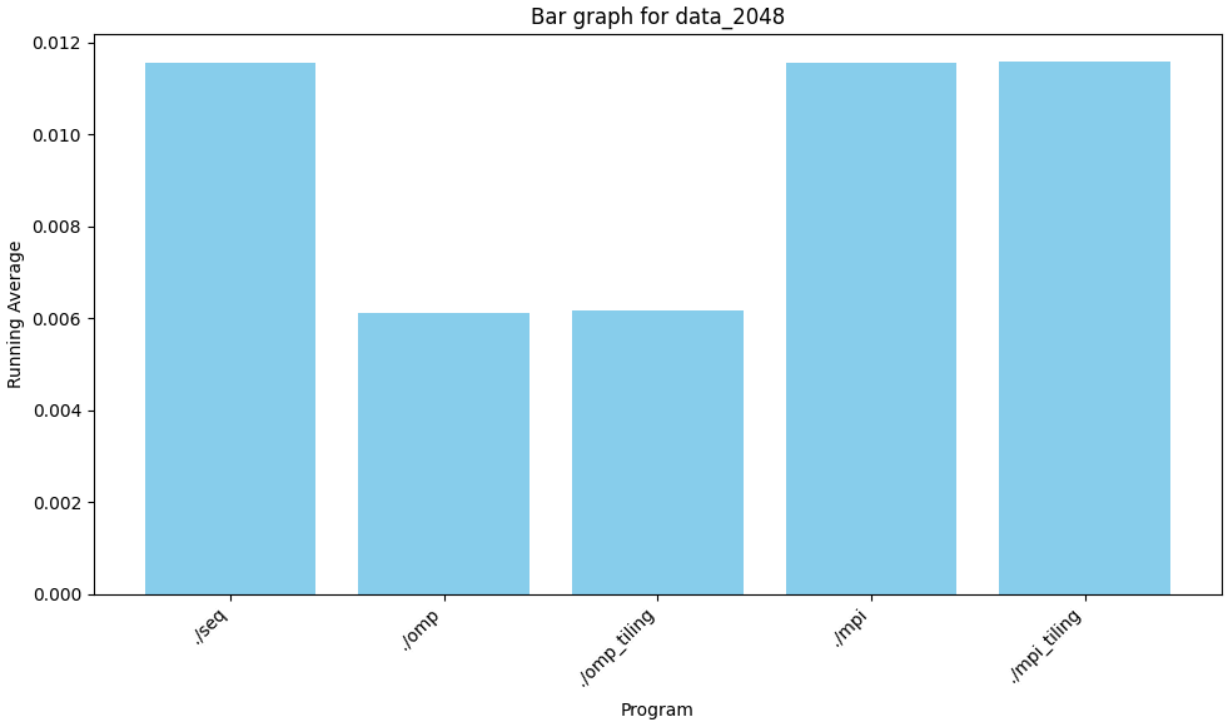
In [9]:
```
x_values = data_dict['data_2048']['Program']
y_values = data_dict['data_2048']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_2048')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 4096

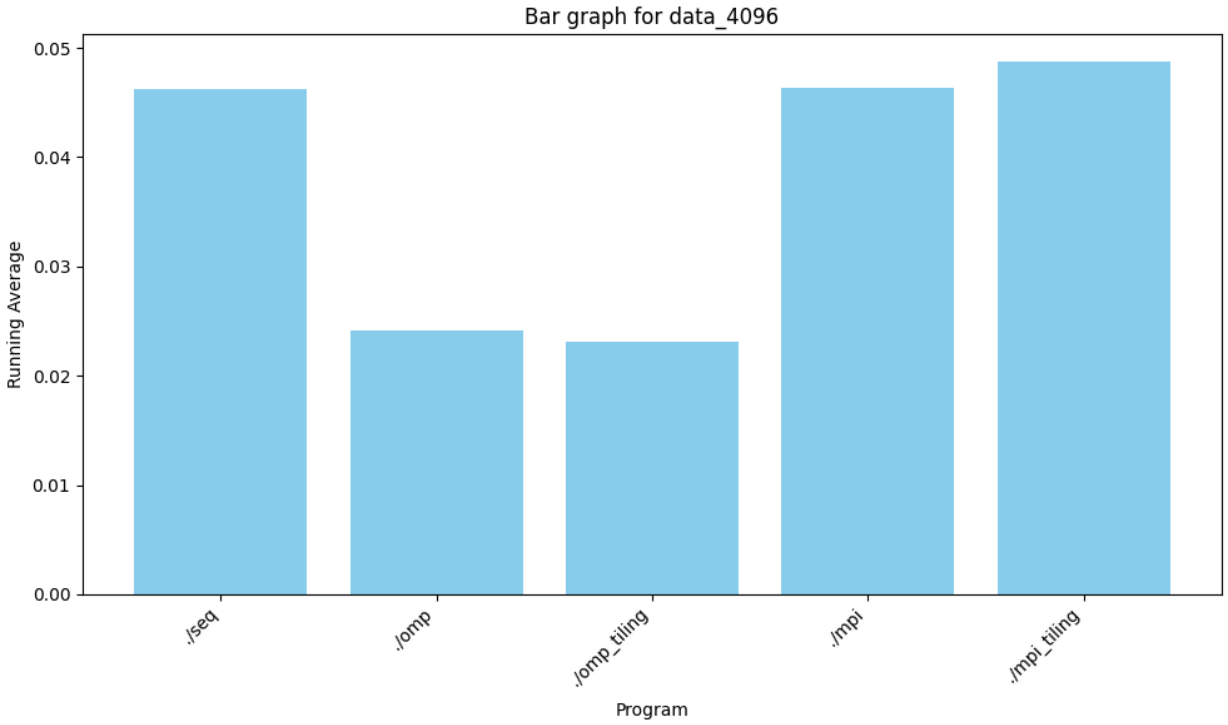
In [10]:
```
x_values = data_dict['data_4096']['Program']
y_values = data_dict['data_4096']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_4096')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 8192

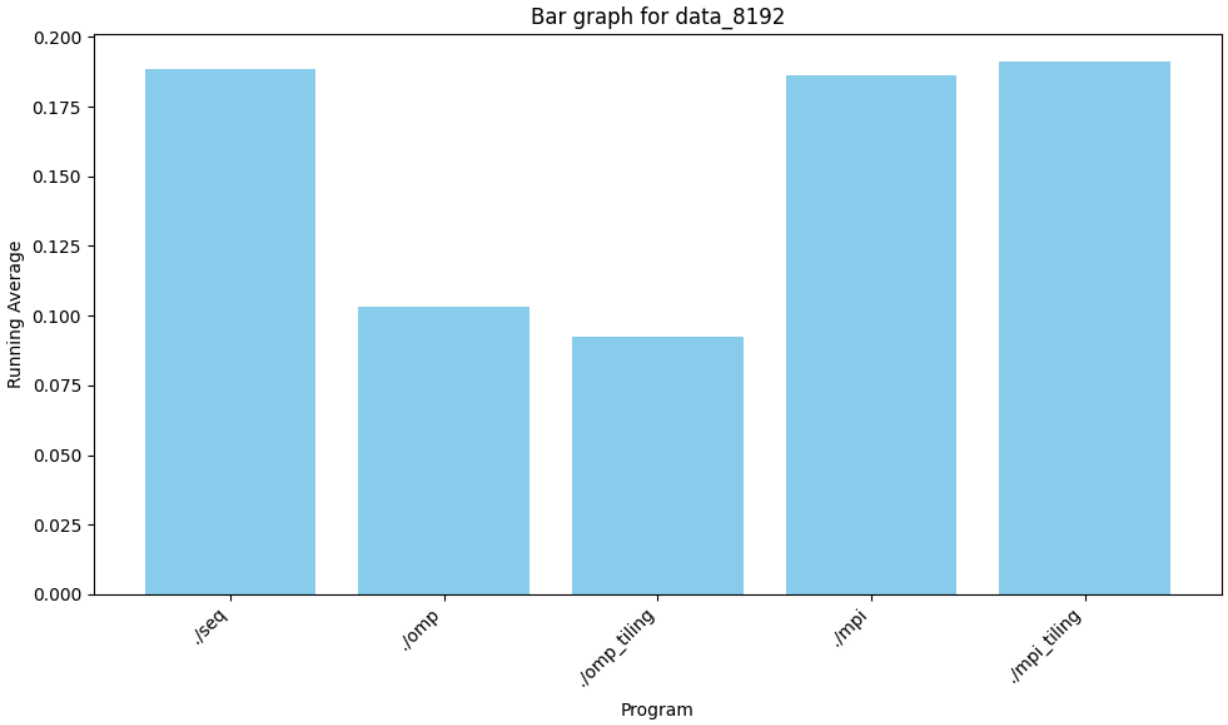
In [11]:
```
x_values = data_dict['data_8192']['Program']
y_values = data_dict['data_8192']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_8192')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 16384

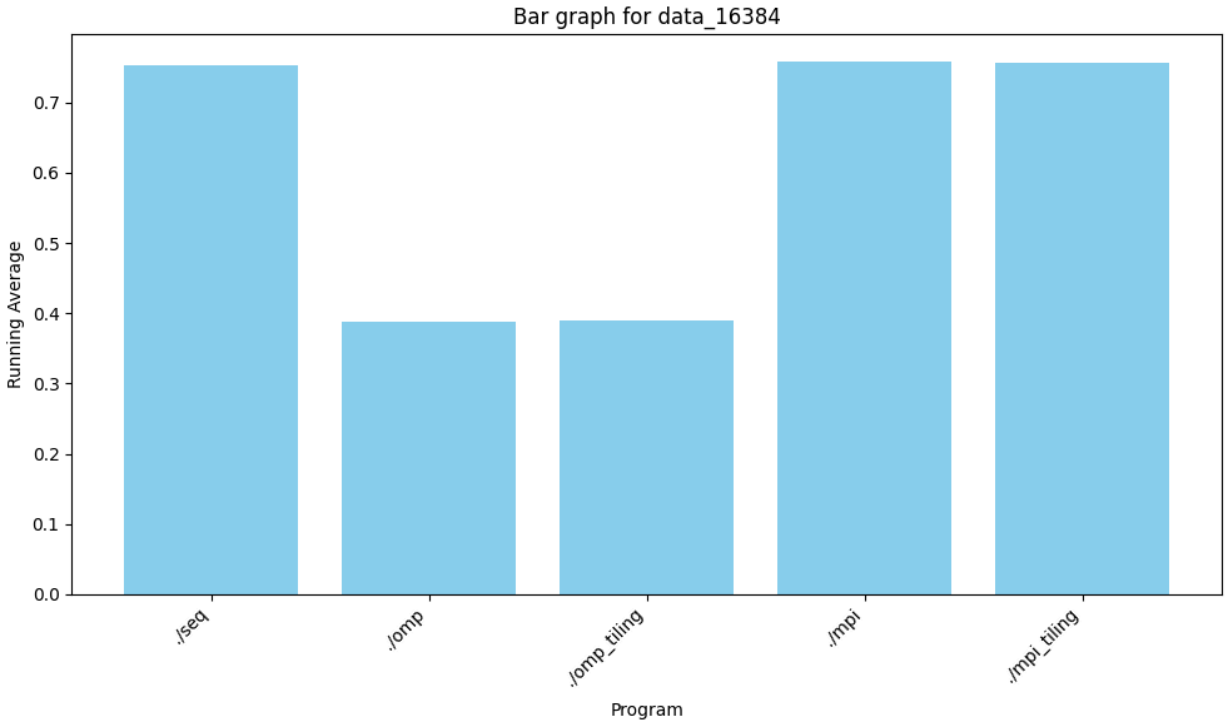
In [12]:
```
x_values = data_dict['data_16384']['Program']
y_values = data_dict['data_16384']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_16384')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```



For input size = 32768

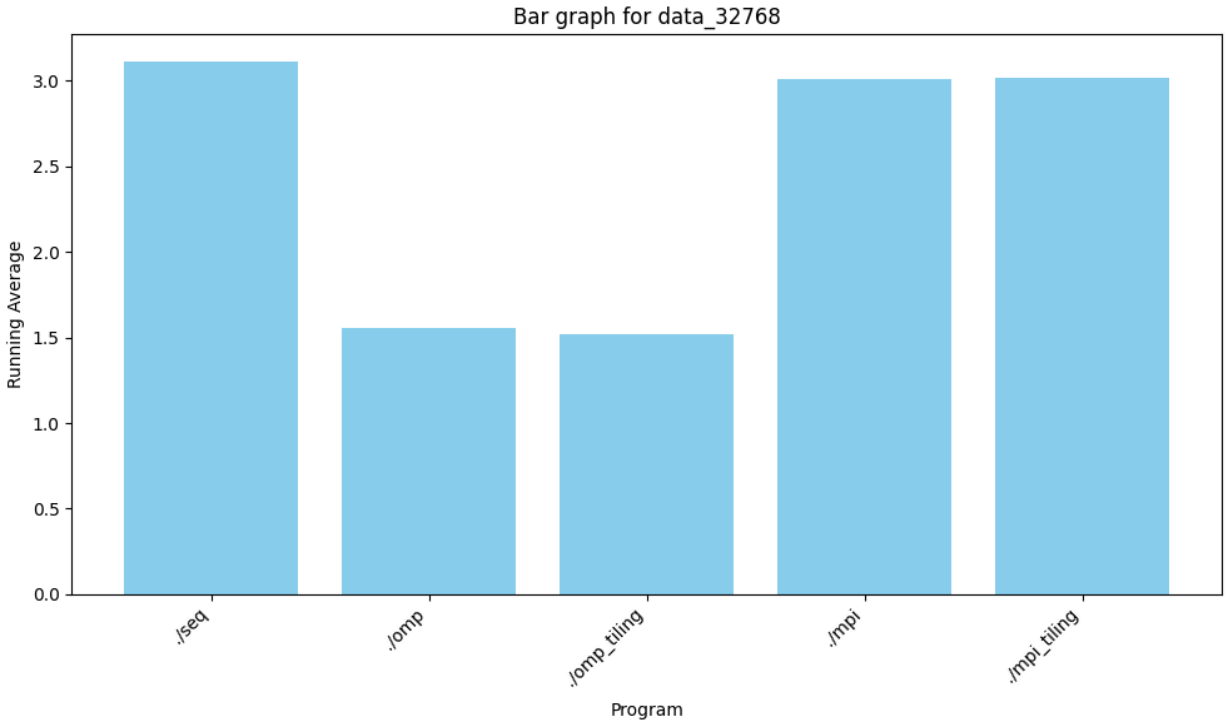
In [13]:
```
x_values = data_dict['data_32768']['Program']
y_values = data_dict['data_32768']['Running Average']

plt.figure(figsize=(10, 6))
plt.bar(x_values, y_values, color='skyblue')

plt.xlabel('Program')
plt.ylabel('Running Average')
plt.title('Bar graph for data_32768')

plt.xticks(rotation=45, ha='right')

plt.tight_layout()
plt.show()
```


Bar graph for data_32768
Running Average
3.0
2.5
2.0
1.5
1.0
0.5
0.0
./seq
./omp
./omp_tiling
./mpi
./mpi_tiling
Program