Max Subarray problem.ipynb

```python
#%%
import random
import matplotlib.pyplot as plt
import time

#%% md
## Dynamic Programming
#%%

def kadane(arr):
    m = len(arr)
    local_max = 0
    global_max = -float('inf')
    for i in range(0, m):
        local_max = max(arr[i], arr[i] + local_max)
        if local_max > global_max:
            global_max = local_max
    return global_max

# %%

#%% md
## Divide and Conquer
#%%
def maxCrossingSum(arr, low, mid, high):
    sum = 0
    left_sum = float("-inf")
    for i in range(mid, low-1, -1):
        sum += arr[i]

        if sum > left_sum:
            left_sum = sum

    sum = 0
    right_sum = float("-inf")
    for i in range(mid, high+1, 1):
        sum += arr[i]

        if sum > right_sum:
            right_sum = sum

    return max(
        left_sum,
        right_sum,
        left_sum + right_sum - arr[mid]
    )

def maxSubarraySum(arr, low, high):
    max_val = float("-inf")
    if low > high:
        return max_val
    if low == high:
        return arr[low]
    mid = (low + high) // 2

    return max(
        maxSubarraySum(arr, low, mid-1),
        maxSubarraySum(arr, mid+1, high),
        maxCrossingSum(arr, low, mid, high)
    )



#%% md
## Main
#%%
if __name__ == '__main__':
    time_arr_dp = []
    time_arr_dc = []
    for j in range(10):
        M = [random.randint(-6000, 6000) for i in range(10000)]
        # Dynamic Programming
        start_time = time.time()
        max_subarray_large = kadane(M)
        end_time = time.time()
        time_arr_dp.append(end_time - start_time)
        # Divide and Conquer
        start_time = time.time()
        dc_max = maxSubarraySum(M,0,len(M)-1)
        end_time = time.time()
        time_arr_dc.append(end_time - start_time)
    plt.plot(time_arr_dp,color = "red",linestyle = "-",marker = "o",label = "Dynamic Programming")
    plt.plot(time_arr_dc,color="blue",linestyle = "--",marker="s",label = "Divide and Conquer")
    plt.xlabel("iterations")
    plt.ylabel("time taken")
    plt.legend()
    plt.show()

#%%
```