Task 8: Australian domestic flights (FOR ASSESSMENT)

> **i** **This task will be assessed**. You should submit it by **5pm on Monday 4 April 2021 (Sydney time)**, by clicking the '**Submit**' button below your code.

> **i** You will get a **mark out of 7**, according to the following scheme:
> - **Free from syntax and runtime errors**: **1 mark**;
> - **Correct logic - Q1**: **1 mark**;
> - **Correct logic - Q2**: **1 mark**;
> - **Correct logic - Q3**: **1 mark**;
> - **Correct logic - Q4**: **1 mark**;
> - **Good choice of variable/function names**: **1 mark**;
> - **Sensible use of comments**: **1 mark**.

In the workspace on the right is a CSV file that contains data about flights along Australia's busiest domestic routes in 2019, modified from a dataset available at data.gov.au.

The columns are:

- **City1**
- **City2**
- **MonthNum**
- **DistanceKm** - the distance in kilometres between the two cities
- **AircraftTrips** - the number of aircraft trips that month between the two cities
- **Seats** - the number of available passenger trips that month between the two cities
- **PassengerTrips** - the number of actual passenger trips that month between the two cities

Write a program that answers the following questions:

1. What were the 10 busiest routes for the year, measured by actual passenger trips, and how many actual passenger trips did they have?

2. For every route, what was their busiest month number, measured by actual passenger trips, and how many actual passenger trips did it have that month? (If there is no unique busiest month, any month will do.)

3. During which month number were there the most actual passenger trips in total across all routes?

4. What were the 10 routes that had the highest proportion of vacant seats during the year, and what were their proportions of vacancy?

> **i** For question 2 you will find it helpful to use the `idxmax()` method of a data frame - you can look it up in the

pandas documentation.

Here is the kind of output that your program should produce:

```
The 10 busiest routes:
City1       City2
MELBOURNE   SYDNEY        9181932
BRISBANE    SYDNEY        4821044
            MELBOURNE     3608681
GOLD COAST  SYDNEY        2733109
ADELAIDE    MELBOURNE     2538061
MELBOURNE   GOLD COAST    2122157
            PERTH         2110125
ADELAIDE    SYDNEY        1878741
PERTH       SYDNEY        1692031
HOBART      MELBOURNE     1670181
Name: PassengerTrips, dtype: int64


Each route's busiest month:
                             BusiestMonth   NumTrips
City1               City2
ADELAIDE            ALICE SPRINGS        7      14610
                    BRISBANE            10      86017
                    CANBERRA            10      18788
                    GOLD COAST           1      21307
                    MELBOURNE           10     232046
...                                    ...        ...
SUNSHINE COAST      MELBOURNE            9      54506
                    SYDNEY               1      64119
SYDNEY              TAMWORTH            11      16383
                    TOWNSVILLE           7      19142
                    WAGGA WAGGA         10      17146

[70 rows x 2 columns]

You could also display all 70 routes as follows:

Each route's busiest month:
                             BusiestMonth   NumTrips
City1               City2
ADELAIDE            ALICE SPRINGS        7      14610
                    BRISBANE            10      86017
                    CANBERRA            10      18788
                    GOLD COAST           1      21307
                    MELBOURNE           10     232046
                    PERTH               10      62148
                    PORT LINCOLN        11      16088
                    SYDNEY              10     176119
```

ALBURY	SYDNEY	10	21479
ALICE SPRINGS	DARWIN	7	13110
	MELBOURNE	1	0
	SYDNEY	1	0
ARMIDALE	SYDNEY	10	11908
AYERS ROCK	SYDNEY	8	19685
BALLINA	SYDNEY	1	45817
BRISBANE	CAIRNS	7	119665
	CANBERRA	7	62171
	DARWIN	7	39625
	EMERALD	10	18854
	GLADSTONE	10	22692
	HAMILTON ISLAND	8	12628
	HOBART	1	25674
	MACKAY	10	71185
	MELBOURNE	10	331472
	MORANBAH	1	0
	MOUNT ISA	8	13501
	NEWCASTLE	10	56940
	PERTH	10	89670
	PROSERPINE	10	24769
	ROCKHAMPTON	7	50811
	SYDNEY	10	447595
	TOWNSVILLE	7	95192
BROOME	PERTH	7	34630
BUNDABERG	BRISBANE	10	14211
CAIRNS	MELBOURNE	7	92279
	SYDNEY	7	109636
	TOWNSVILLE	10	13177
CANBERRA	MELBOURNE	10	111079
	SYDNEY	10	89721
COFFS HARBOUR	SYDNEY	10	31157
DARWIN	MELBOURNE	7	34887
	PERTH	7	17815
	SYDNEY	7	37777
DUBBO	SYDNEY	10	17016
GERALDTON	PERTH	5	9834
GOLD COAST	SYDNEY	1	264968
HAMILTON ISLAND	MELBOURNE	11	8232
	SYDNEY	10	23928
HOBART	MELBOURNE	1	164170
	SYDNEY	1	75075
KALGOORLIE	PERTH	10	26547
KARRATHA	PERTH	10	43237
LAUNCESTON	MELBOURNE	1	97718
	SYDNEY	1	37451
MELBOURNE	GOLD COAST	1	206458
	MILDURA	10	21067
	NEWCASTLE	1	45569
	PERTH	12	197540
	SYDNEY	10	823951
	TOWNSVILLE	1	0
PERTH	NEWMAN	10	32714
	PORT HEDLAND	7	36330

City1	City2	MonthNum	PassengerTrips
	SYDNEY	10	157973
PORT MACQUARIE	SYDNEY	10	17729
PROSERPINE	SYDNEY	10	11398
SUNSHINE COAST	MELBOURNE	9	54506
	SYDNEY	1	64119
SYDNEY	TAMWORTH	11	16383
	TOWNSVILLE	7	19142
	WAGGA WAGGA	10	17146

The overall busiest month:
```
MonthNum
10    5105125
Name: PassengerTrips, dtype: int64
```

The 10 routes with the highest proportion of vacant seats:

City1	City2	Vacancy
ALICE SPRINGS	DARWIN	0.565066
KALGOORLIE	PERTH	0.433001
CAIRNS	TOWNSVILLE	0.418525
GERALDTON	PERTH	0.412624
PERTH	NEWMAN	0.406720
ADELAIDE	PORT LINCOLN	0.397928
PERTH	PORT HEDLAND	0.370486
KARRATHA	PERTH	0.360320
SYDNEY	TAMWORTH	0.349407
MELBOURNE	MILDURA	0.339240