## 1. Doodle Scheduling [10 pts]

## by Roumen Guha, on Sunday, February 19th, 2017

Doodle Inc. is looking to interview a candidate for a new software engineer position at their company. It works like this: the interview (10 AM to 3 PM) is divided into a number of 20-minute time slots that may be used for 1-on-1 meetings with the candidate. There is also a one-hour time slot in the middle of the day where 3 employees take the candidate out for lunch. It would be nice for all 15 senior employees to meet with the candidate at some point during the day, but everybody has a busy schedule so it's not clear whether this will be possible. A doodle poll (obviously) was sent to the 15 senior employees to figure out their availability.

	10:00	10:20	10:40	11:00	11:20	11:40	Lunch	1:00	1:20	1:40	2:00	2:20	2:40
Manuel	0	0	1	1	0	0	0	1	1	0	0	0	0
Luca	0	1	1	0	0	0	0	0	1	1	0	0	0
Jule	0	0	0	1	1	0	1	1	0	1	1	1	1
Michael	0	0	0	1	1	1	1	1	1	1	1	1	0
Malte	0	0	0	0	0	0	1	1	1	0	0	0	0
Chris	0	1	1	0	0	0	0	0	1	1	0	0	0
Spyros	0	0	0	1	1	1	1	0	0	0	0	0	0
Mirjam	1	1	0	0	0	0	0	0	0	0	1	1	1
Matt	1	1	1	0	0	0	0	0	0	1	1	0	0
Florian	0	0	0	0	0	0	0	1	1	0	0	0	0
Josep	0	0	0	0	0	0	1	1	1	0	0	0	0
Joel	1	1	0	0	0	1	1	1	1	0	0	1	1
Tom	1	1	1	0	1	1	0	0	0	0	0	1	1
Daniel	0	1	1	1	0	0	0	0	0	0	0	0	0
Anne	1	1	0	0	1	1	0	0	0	0	0	0	0

In the table, a 1 means that the employee is available at the indicated time, while a 0 means that they are unavailable. Determine whether a feasible interview schedule exists. If so, print out a calendar for the candidate that lists who they will be meeting at each time slot.

```
In [6]: using NamedArrays

# import data set
raw = readcsv("1b.csv")  # A file I made
(m, n) = size(raw)

n_times = 2:n  # columns containing times
n_names = 2:m  # rows containing names

times = raw[1, n_times][:]  # the list of times (convert to 1-D array)
names = raw[n_names, 1][:]  # the list of names (convert to 1-D array)

# data[f,i] is the entire schedule
data = NamedArray(raw[n_names, n_times], (names, times), ("names", "times"))
show(IOContext(STDOUT, displaysize=(100, 1000)), data)
```

15×15 Named Arı	ray{Any,	2}													
names \ times	10:00	10:20	10:40	11:00	11:20	11:40	12:00	12:20	12:40	13:00	13:20	13:40	14:00	14:20	14:40
Manuel	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0
Luca	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0
Jule	0	0	0	1	1	0	1	1	1	1	0	1	1	1	1
Michael	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0
Malte	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0
Chris	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0
Spyros	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Mirjam	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1
Matt	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0
Florian	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Josep	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0
Joel	1	1	0	0	0	1	1	1	1	1	1	0	0	1	1
Tom	1	1	1	0	1	1	0	0	0	0	0	0	0	1	1
Daniel	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Anne	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0

```
In [7]: using JuMP
        m = Model()
        @variable(m, x[names, times] >= 0)
        # the candidate can only meet with 1 employee at any 20-minute period
        @constraint(m, a[j in times], sum(x[i,j] for i in names) <= 1)</pre>
        # each employee can only meet with the candidate once
        @constraint(m, b[i in names], sum(x[i,j] for j in times) <= 1)</pre>
        @objective(m, Max, sum(x[i,j]*data[i,j] for i in names, j in times))
        status = solve(m)
        println(status)
        schedule = NamedArray( [Int(getvalue(x[i,j])) for i in names, j in times], (names, times), ("Names", "Times"))
        show(IOContext(STDOUT, displaysize=(100, 1000)), schedule)
        Optimal
        15×15 Named Array{Int64,2}
        Names \ Times |
                        10:00 10:20 10:40 11:00 11:20 11:40 12:00 12:20 12:40 13:00 13:20 13:40 14:00 14:20 14:40
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        Matt
```

## Note:

Florian

Josep

Joel

Tom

Daniel

Anne

To account for the lunch period, I simply split the lunch hour into 3 separate 20-minute periods with identical data.

Schedule is as follows:

```
10:00: Joel
10:20: Luca
10:40: Manuel
11:00: Daniel
11:20: Spyros
11:40: Anne
12:00: Jule
12:20: Michael
12:40: Malte
13:00: Josep
13:20: Florian
13:40: Chris
14:00: Matt
14:20: Mirjam
14:40: Tom
```

This means that Jule, Michael and Malte get to join the candidate for lunch. Lucky them.

```
Max x[Manuel, 10:40] + x[Manuel, 11:00] + x[Manuel, 13:00] + x[Manuel, 13:20] + x[Luca, 10:20] + x[Luca, 10:40] + x[Luca, 13:20] + x[Luca, 13:40] + x[Jule, 11:00] + x[Jule, 11:20] + x[Jule, 1
2:00] + x[Jule,12:20] + x[Jule,12:40] + x[Jule,13:00] + x[Jule,13:40] + x[Jule,14:00] + x[Jule,14:20] + x[Jule,14:40] + x[Michael,11:00] + x[Michael,11:20] + x[Michael,11:40] + x[Mic
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+ x[Malte, 12:40] + x[Malte, 13:00] + x[Malte, 13:20] + x[Chris, 10:20] + x[Chris, 10:40] + x[Chris, 13:20] + x[Chris, 13:40] + x[Spyros, 11:00] + x[Spyros, 11:20] + x[Spyros, 11:40] + x[Spyros, 11:40]
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