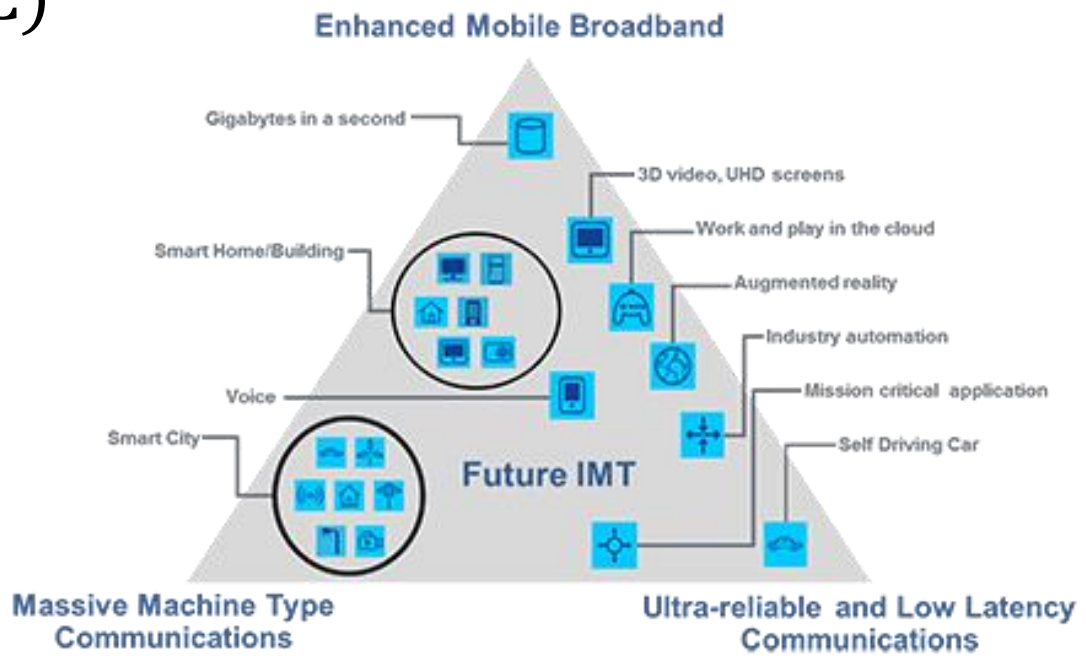
Data Structures
Programming Project #2

The Fifth-generation (5G) Network

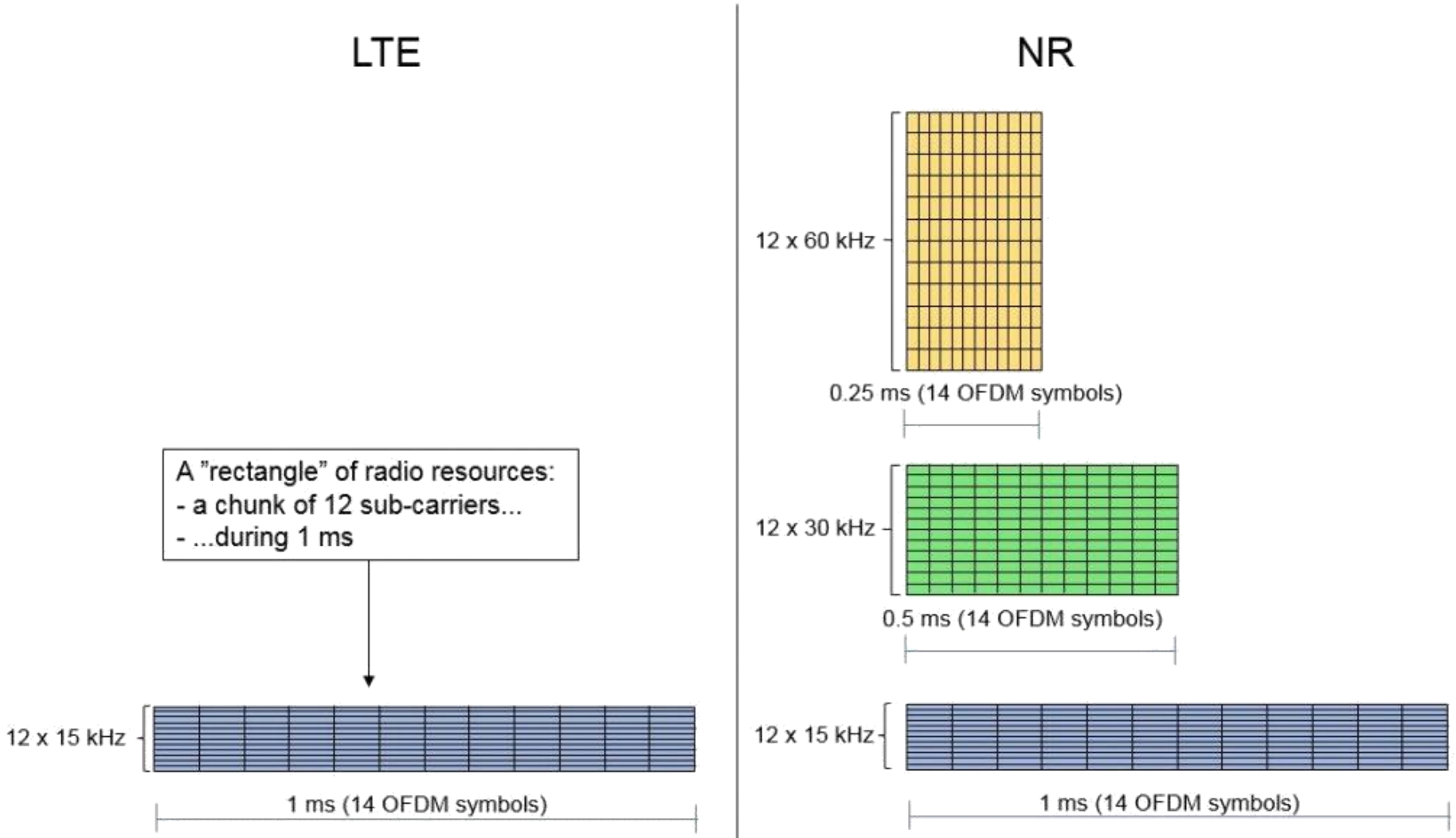
- Enhance mobile broadband (EMBB)
- Massive machine type communications (MMTC)
- Ultra-reliable and low latency communications (URLLC)



The Fifth-generation (5G) Network

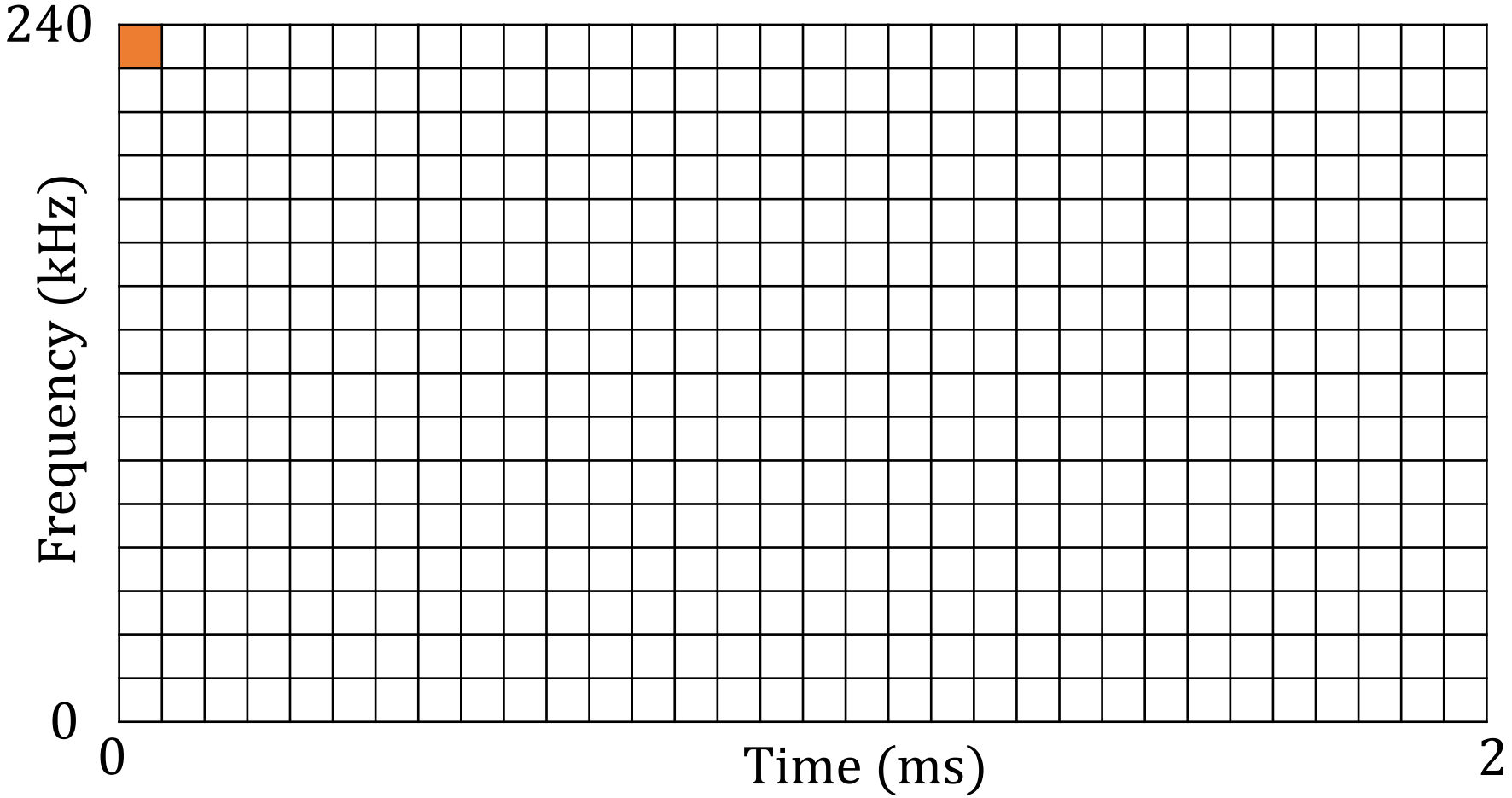
- New Radio (NR): flexible frame structure with multi-numerology technology
- Adjustable subcarrier spacing (SCS) and transmission time interval (TTI)

New Radio Numerologies



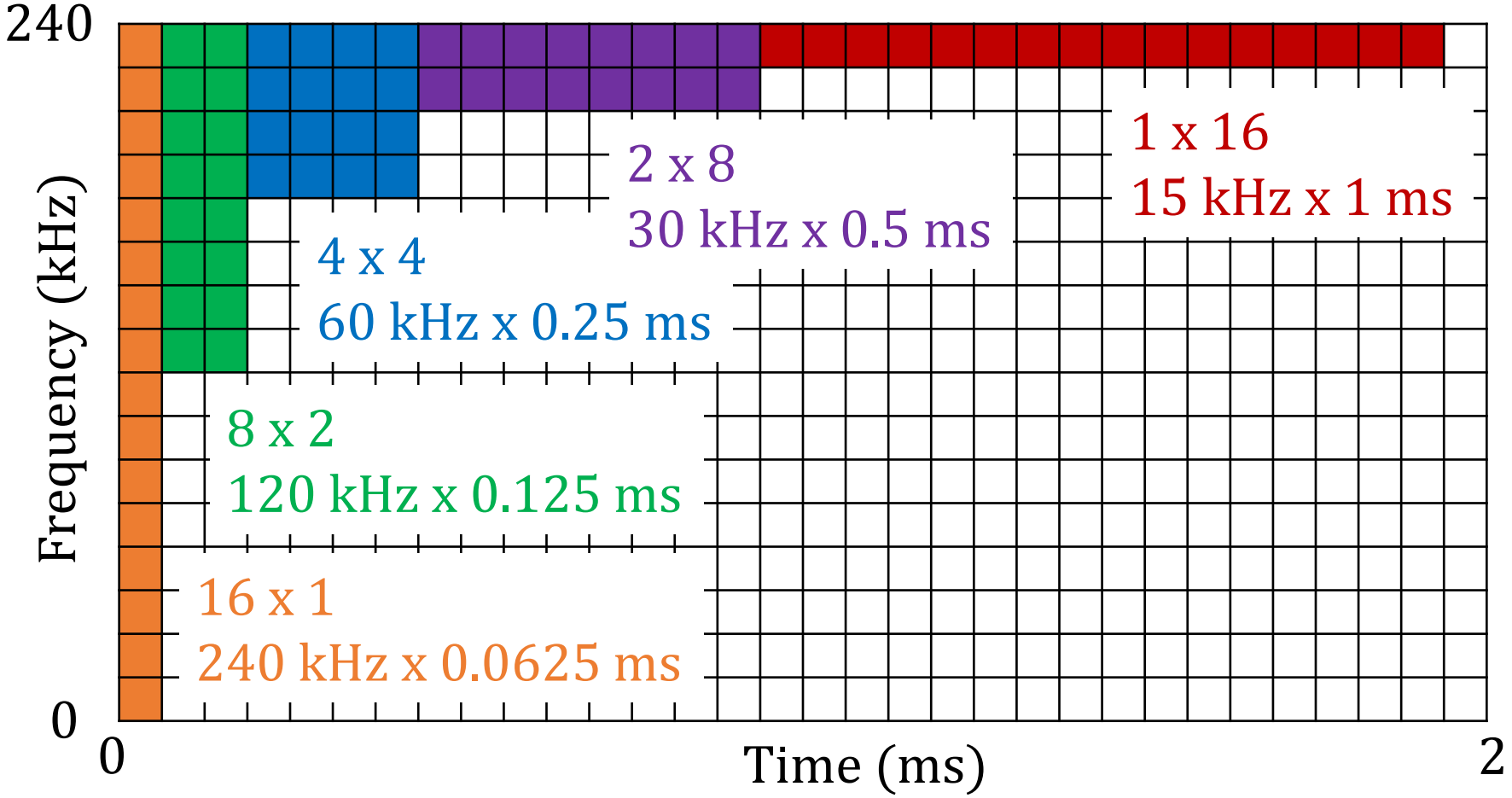
Basic Unit (BU) in NR

- A rectangle of 15 kHz x 0.0625 ms



Multi-numerology in NR

- Various types of rectangles (16 BUs)



Similar to Sorting Function in Diablo 2…

Users in 5G networks

- Each user has a set of candidate shapes due to the quality of service (QoS) requirement

- For example,

  a request for video streaming:
  2 x 8, and 1 x 16

  a request for V2V transmission:
  16 x 1, 8 x 2, and 4 x 4

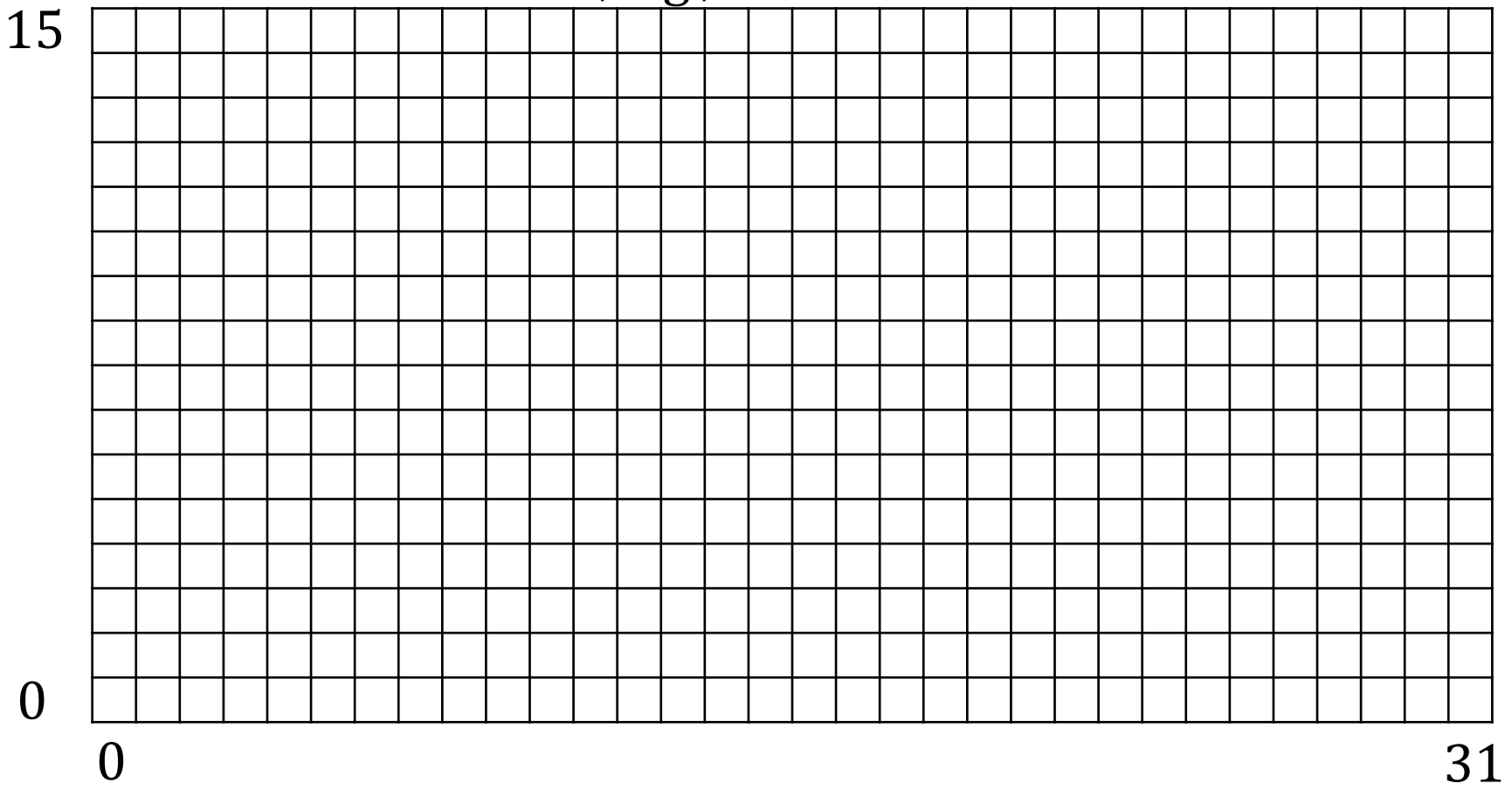
System Model & Problem Formulation

- Given:
- The wireless transmission resource (frequency, time)
- Users, each of which has a set of candidate shapes

- Goal: maximize the number of accepted requests
- Constraints: No request shares BUs with others

Programming Project #2:
2D Resource Allocation Problem with NR

- Input:
  - A $Y \times X$ resource:, e.g., 16×32



Programming Project #2:
2D Resource Allocation Problem with NR

- Input:
  - A $Y \times X$ resource:, e.g., 16×32
  - User, each of which has a set of candidate shapes e.g., 2×8 and 1×16
- Procedure:
  - Accept or reject each user
  - Choose a shape for each accepted user
  - Put the shapes of accepted users into the resource without overlap
- Output:
  - The accepted users, their shapes, and shapes' positions
- The grade is proportional to the number of accepted users

The Competition

- The grade is proportional to # accepted users
- Basic: 60 (deadline)
  - A baseline solution (see the following pages)
- Performance ranking (decided after the deadline)
  - [0%, 30%) (bottom): +0
  - [30%, 50%): + 5
  - [50%, 75%): + 10
  - [75%, 85%): + 15
  - [85%, 90%): + 20
  - [90%, 95%): + 25
  - [95%, 100%] (top): + 30
- Homework assistant (superb deadline)
  - +10

The Competition

- The grade … users
- Basic: 60
  - A baseli… s)
- Performa… deadline)
  - [0%, 30…
  - [30%, 5…
  - [50%, 7…
  - [75%, 8…
  - [85%, 9…
  - [90%, 9…
  - [95%, 1…
- Homework assistant (superb deadline)
  - +10

The Competition

- The grade
- Basic: 60
  - A baseli
- Performa
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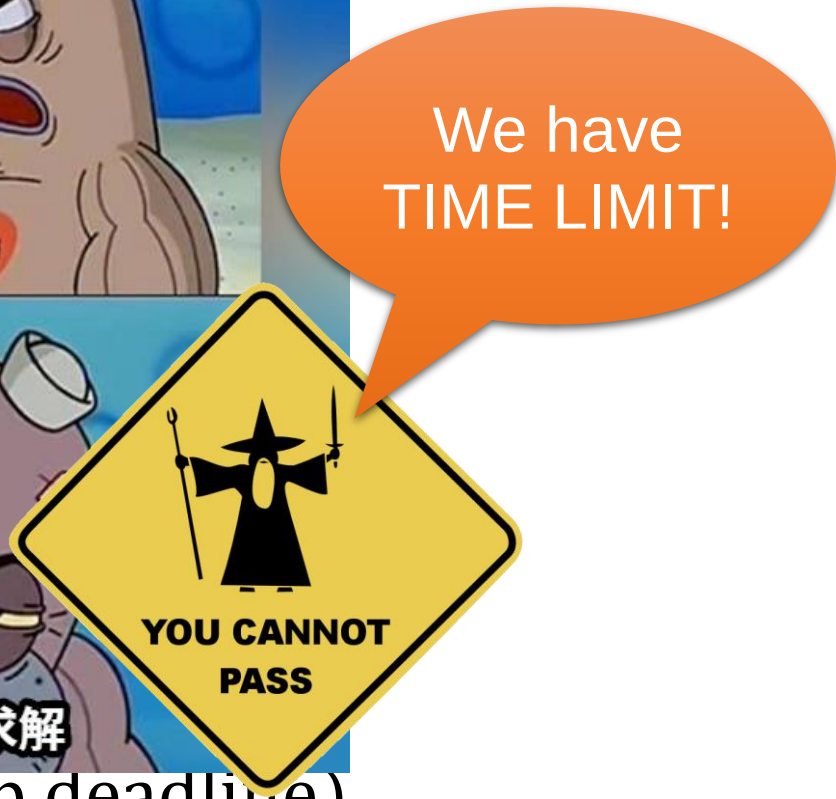
users



The Baseline Algorithm (這方法很爛)

- Sequentially set each user's shape to the first candidate shape
- E.g., 2 x 8, and 1 x 16
  choose the first one, so 2 x 8

- Sequentially put the users' shapes
  on the bottom from the left (0, 0) to the right (31, 0)
  (see the example in the next page)

Input Sample: use scanf

Format: Frequency Time

ResourceY ResourceX #Users

UserID CandidateShape1 CandidateShape2 ...

Ex:

16 32 5

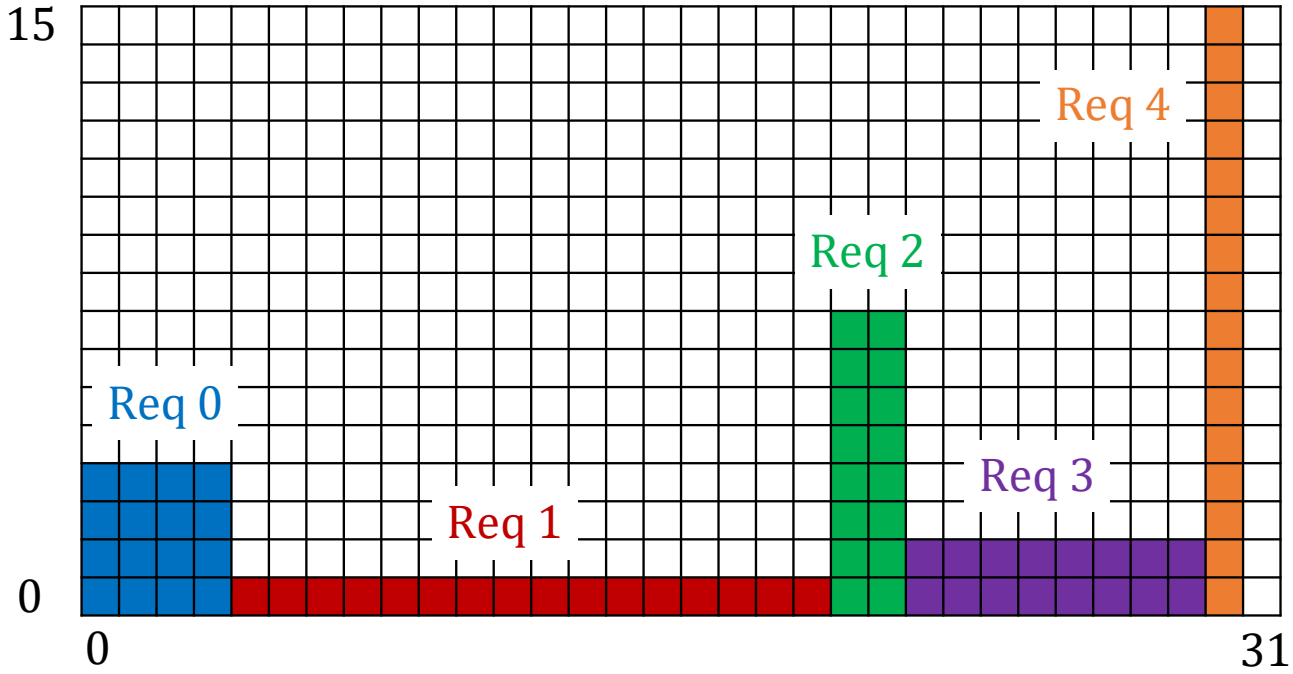
0 4x4 2x8

1 1x16

2 8x2 4x4 2x8

3 2x8 1x16

4 16x1 8x2 4x4 2x8 1x16



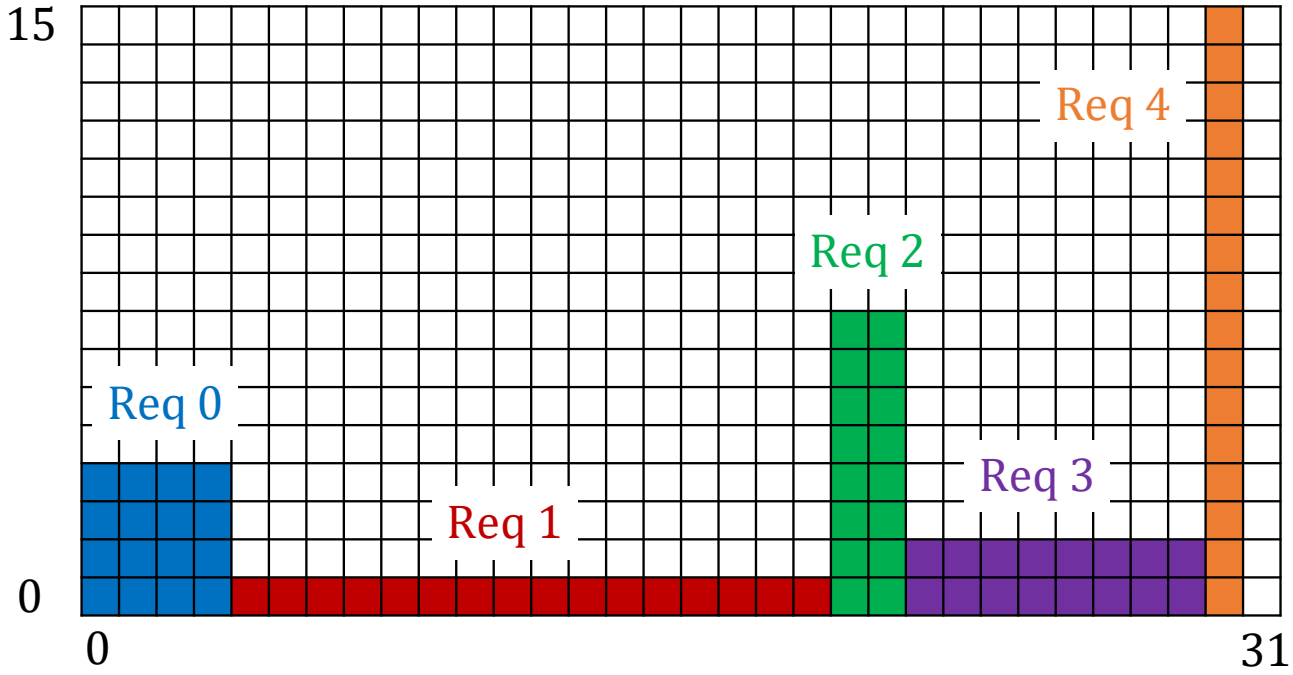
Output Sample: use printf

Format: Frequency Time

#AcceptedUsers

UserID UsedShape PositionY PositioinX

...



Ex:

5

0 4x4 0 0

1 1x16 0 4

2 8x2 0 20

3 2x8 0 22

4 16x1 0 30

The solution is generated by the baseline → You can design your algorithm to beat it

Note

- Superb deadline: 11/1 Tue (adjust?)
- Deadline: 11/8 Tue (adjust?)
- Pass the test of our online judge platform
- Submit your code to E-course2
- Demonstrate your code remotely with TA
- **C Source code (i.e., only .c)**
- Show a good programming style

Today!!!

- Taiwanese Computer Science Day
- 1111011