



FINAL PROJECT RULES

Introduction to Programming 2019





1P ▲04
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2P ▲00

SPEED	RIPPLE	FORCE
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Salamander (1986)



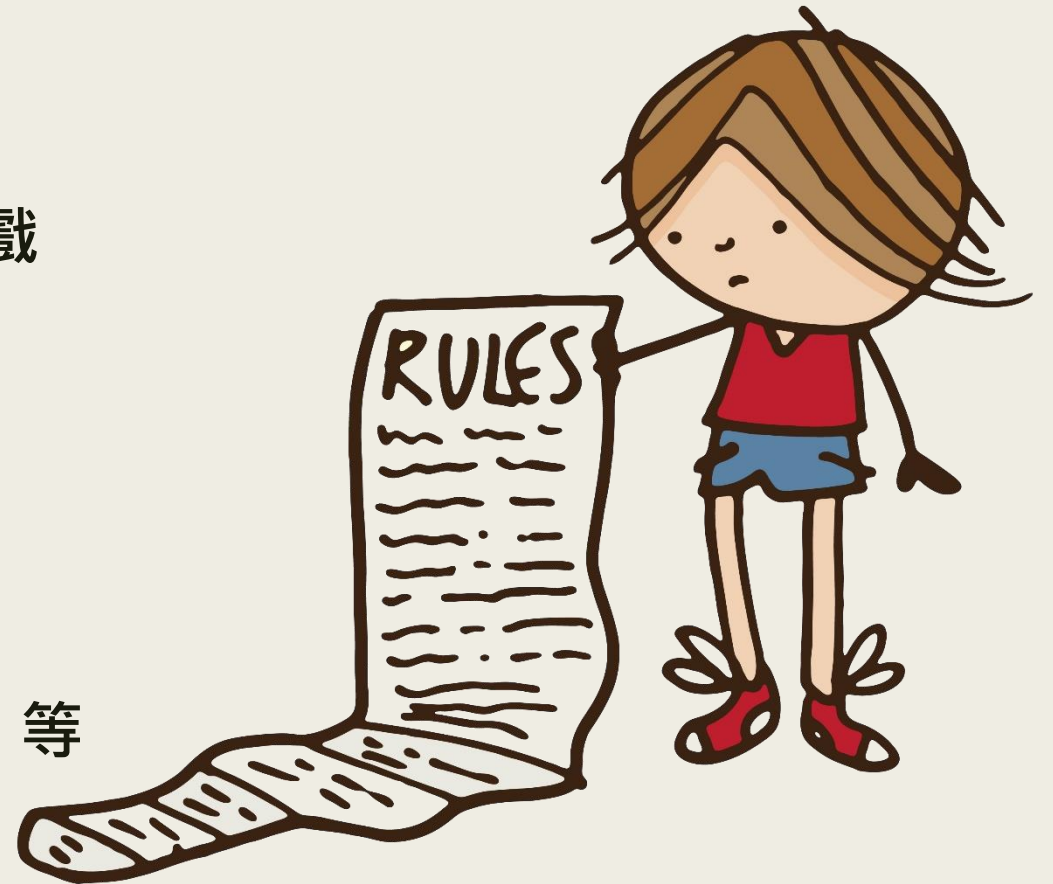
Raystorm (1996)



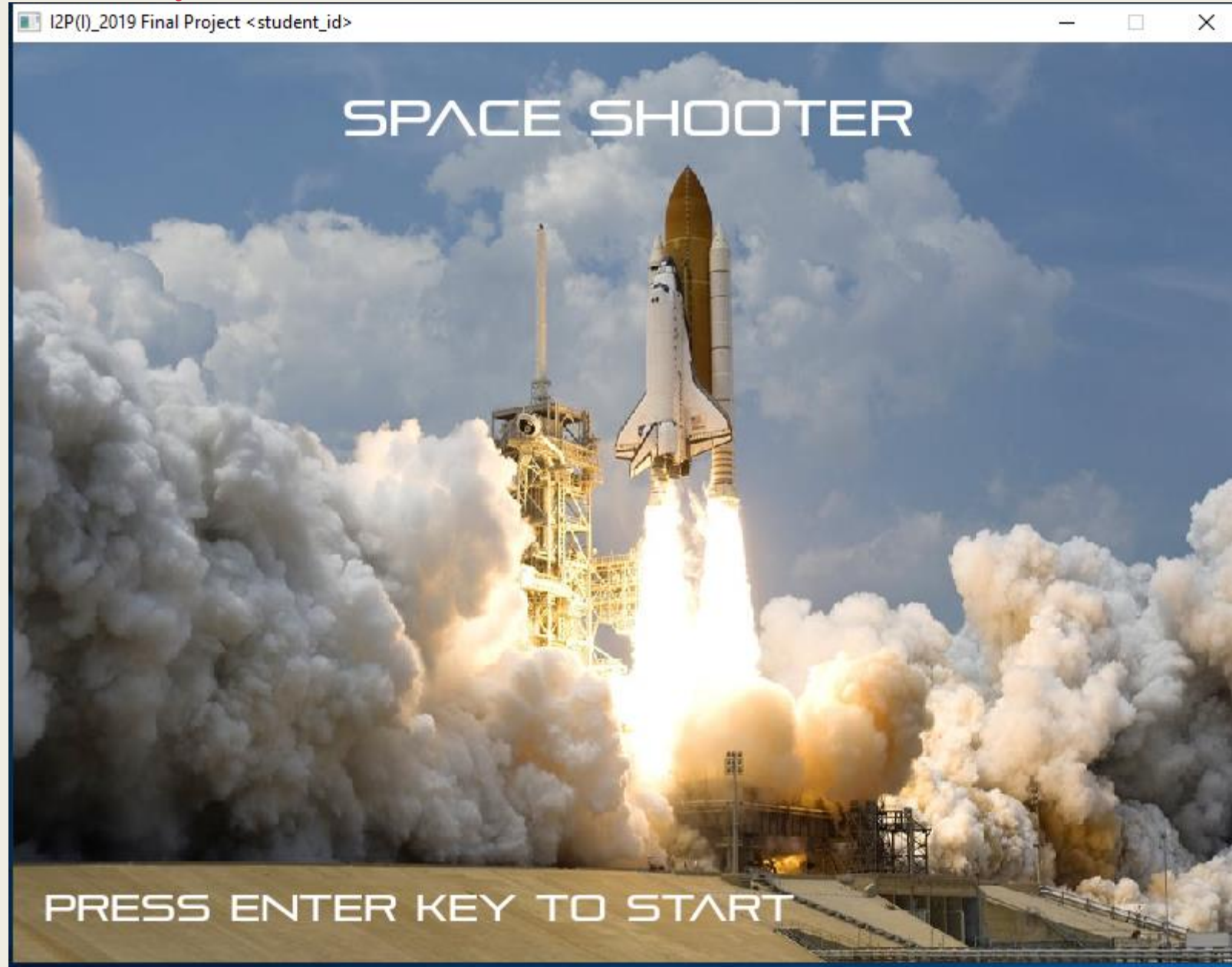
東方永夜抄 ~ Imperishable Night. (2004)

Rules

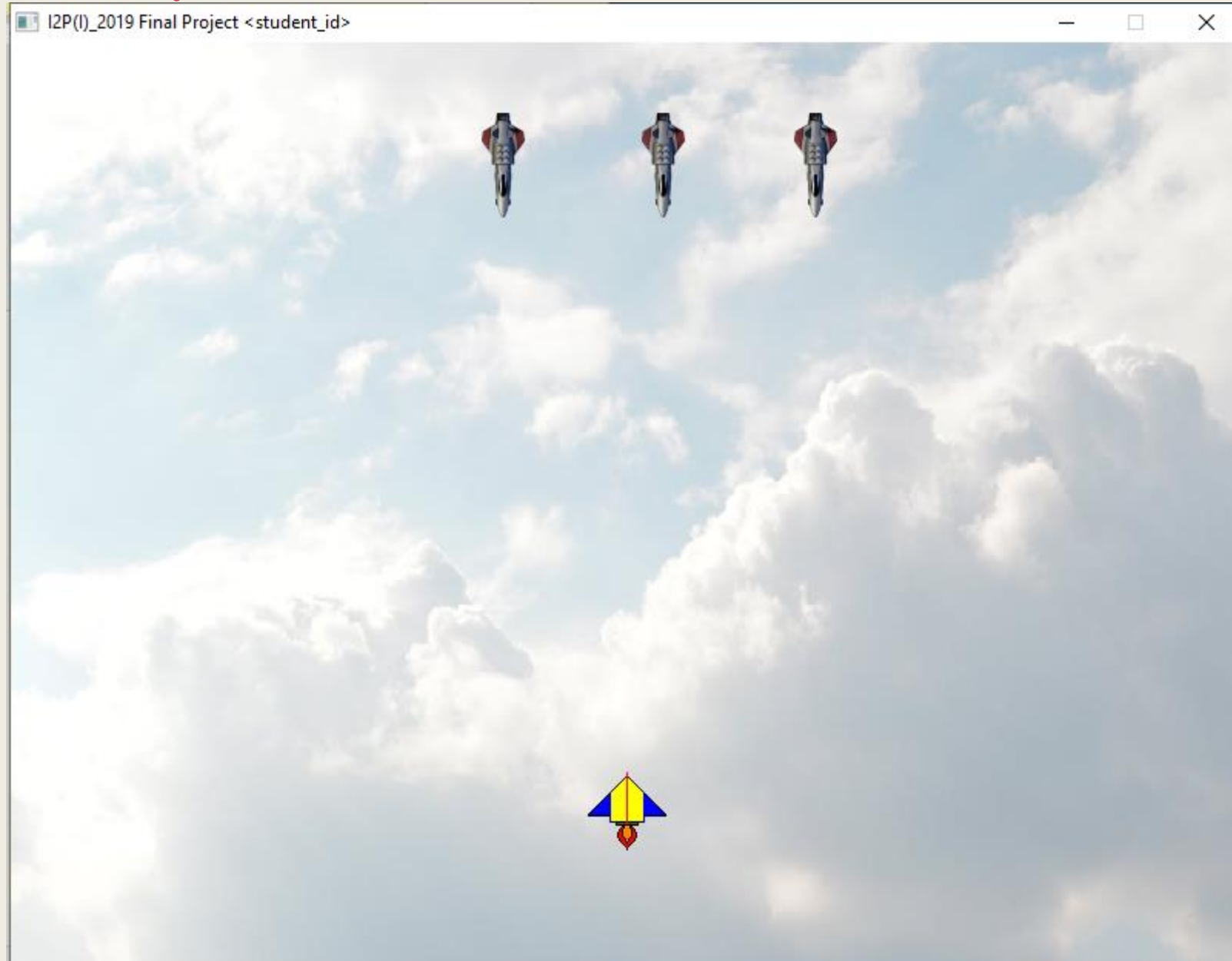
- 一人一組
- 占學期總成績15%
- 使用 Allegro 5 獨立完成 戰機射擊遊戲
- 必須使用我們提供的 template
- 2020年1月13日(一) Demo
 - 需自備筆電來 demo
 - 詳細資訊前一週會公布
- 只能用 C 語言，其他如 C++, Python 等都不行

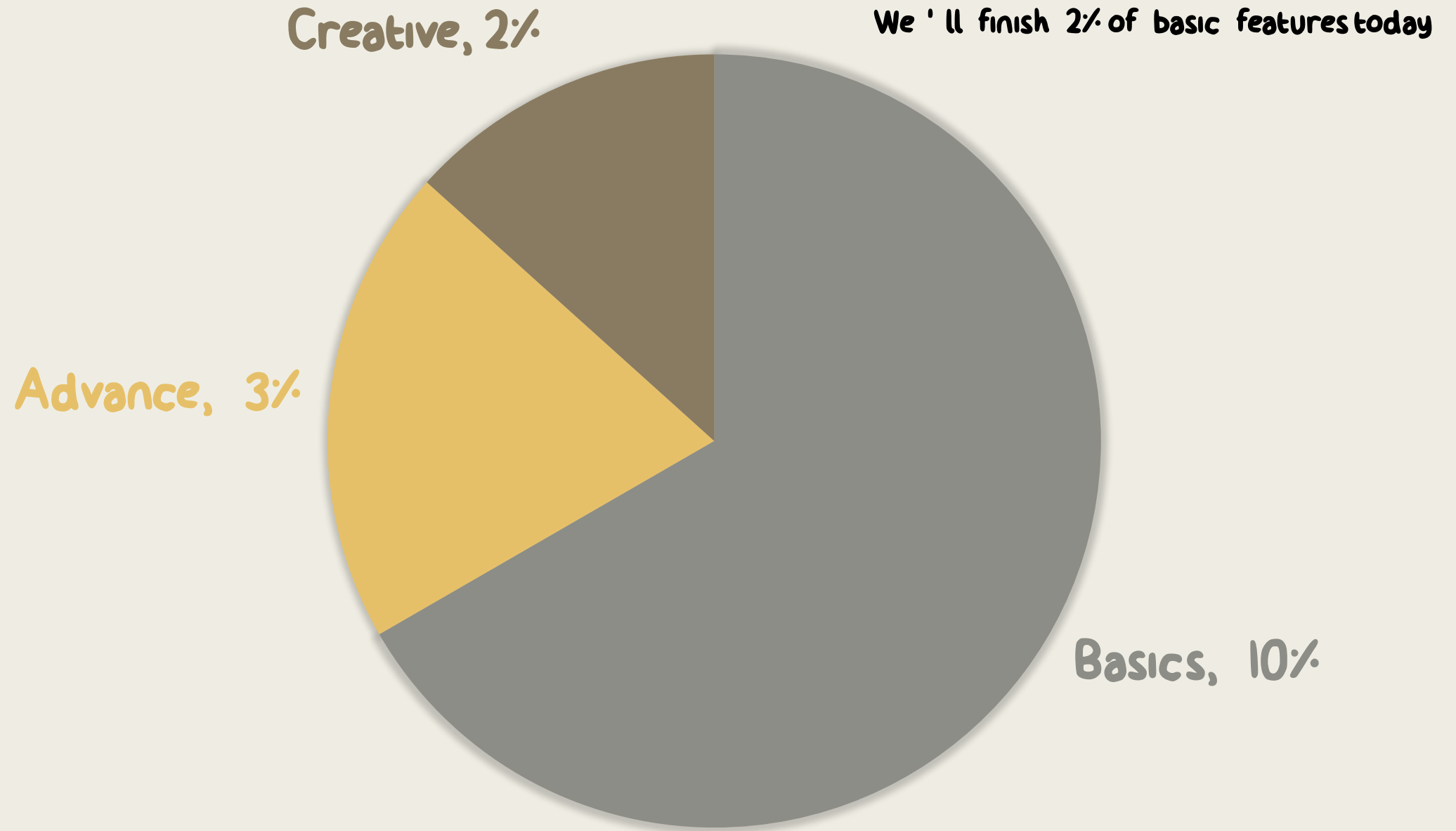


Given template



Given template





Basics (10%)

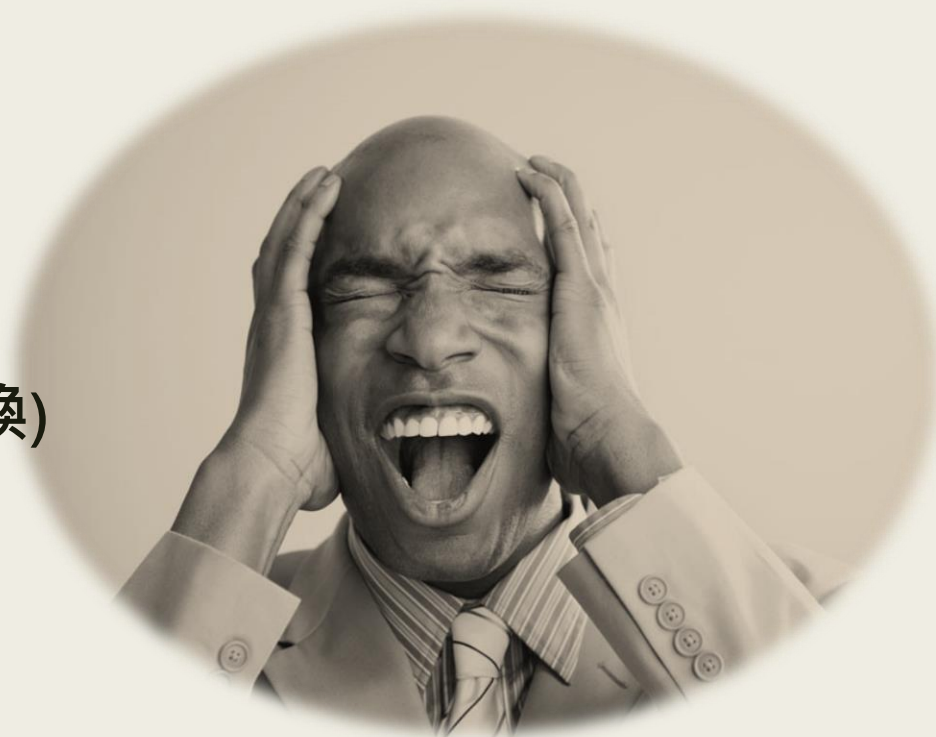
- 遊戲完整性
- 遊戲中進行計分
- 戰機 (不能超出畫面)、敵人、子彈都能正確移動
- 子彈能造成傷害
- 血條 (HP) / 剩餘生命 (lives)
- 使用滑鼠和鍵盤
- 除了 Menu, Start, Settings 的第四個場景
 - e.g. Win, Game over, Restart, End, ...
- 2% for today (the features marked in red.)



Advance (3%)

- 開頭 + 角色動畫
- 永久計分 (排行榜 / 存檔)
- 2.5D 場景
- 2P 模式 (合作破關)
- 角色選擇
- 音效 + 音樂 (在不同場景下需要轉換)
- 魔王
- 華麗大絕

選上面其中三個



Creative (2%)

- 角色精細度
- 技能華麗度
- 動畫炫泡度
- 遊戲豐富度
- 整體流暢度
-



Template

- Single file template
 - *Template (basic).zip*
 - Easier to get used to, but it would be messy when you implement too many features.
- Multiple file template
 - *Template (advanced).zip*
 - Harder to get used to, but functions and scenes are separated to different files.

Template (if you use Allegro 5.0)

- Change

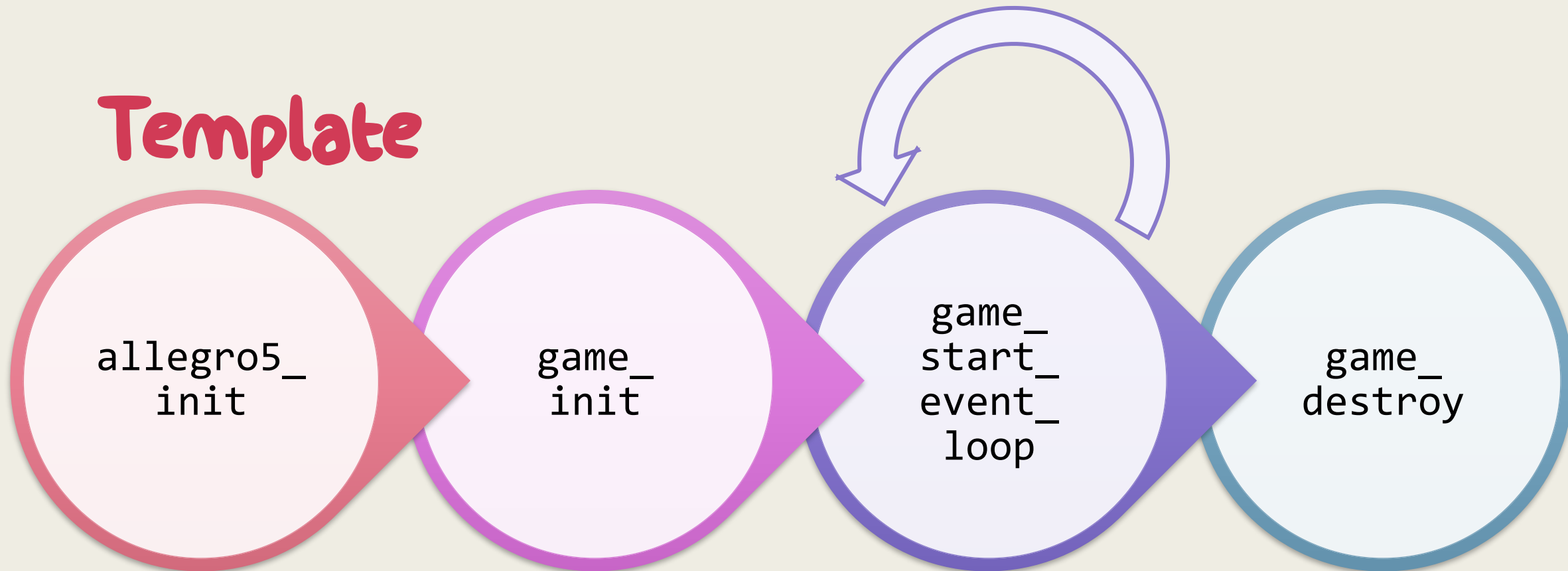
```
if (!al_init_font_addon())  
    game_abort("failed to initialize font add-on");
```

to

```
al_init_font_addon();
```

- (You only need to fix this if you followed the tutorial that uses `allegro-5.0.10-monolith-mt.dll`)

Template



Init lib routines

- init/install
- create display, event queue, timer
- register events
- start timer

Init variables

- load resources
- change scene
 - to main scene

Process events

- close window
- timer
 - update
 - draw
- keyboard events
- mouse events

Free variables

- free resources
- change scene to main scene

Template (states)

```
// The active scene id.  
int active_scene;  
// Keyboard state, whether the key is down or not.  
bool key_state[ALLEGRO_KEY_MAX];  
// Mouse state, whether the key is down or not.  
// 1 is for left, 2 is for right, 3 is for middle.  
bool *mouse_state;  
// Mouse position.  
int mouse_x, mouse_y;
```

Template (structs)

```
typedef struct {  
    // The center coordinate of the image.  
    float x, y;  
    // The width and height of the object.  
    float w, h;  
    // The velocity in x, y axes.  
    float vx, vy;  
    // Should we draw this object on the screen.  
    bool hidden;  
    // The pointer to the object's image.  
    ALLEGRO_BITMAP* img;  
} MovableObject;
```

Template (routines)

```
// Initialize allegro5 library
void allegro5_init(void);
// Initialize variables and resources.
void game_init(void);
// Process events inside the event queue using an infinity loop.
void game_start_event_loop(void);
// Release resources.
void game_destroy(void);
// Function to change from one scene to another.
void game_change_scene(int next_scene);
```


Template (events/callbacks)

```
// This is called when the game should update its logic.  
void game_update(void);  
// This is called when the game should draw itself.  
void game_draw(void);  
void on_key_down(int keycode);  
void on_mouse_down(int btn, int x, int y);
```

Template (utilities / callbacks)

```
void draw_movable_object(MovableObject obj);  
// Load resized bitmap and check if failed.  
ALLEGRO_BITMAP *load_bitmap_resized(const char *filename, int w, int h);  
// Display error message and exit the program, used like 'printf'.  
// Write formatted output to stdout and file from the format string.  
// If the program crashes unexpectedly, you can inspect "log.txt" for  
// further information.  
void game_abort(const char* format, ...);  
// Log events for later debugging, used like 'printf'.  
// Write formatted output to stdout and file from the format string.  
// You can inspect "log.txt" for logs in the last run.  
void game_log(const char* format, ...);
```

Template (Advanced version)

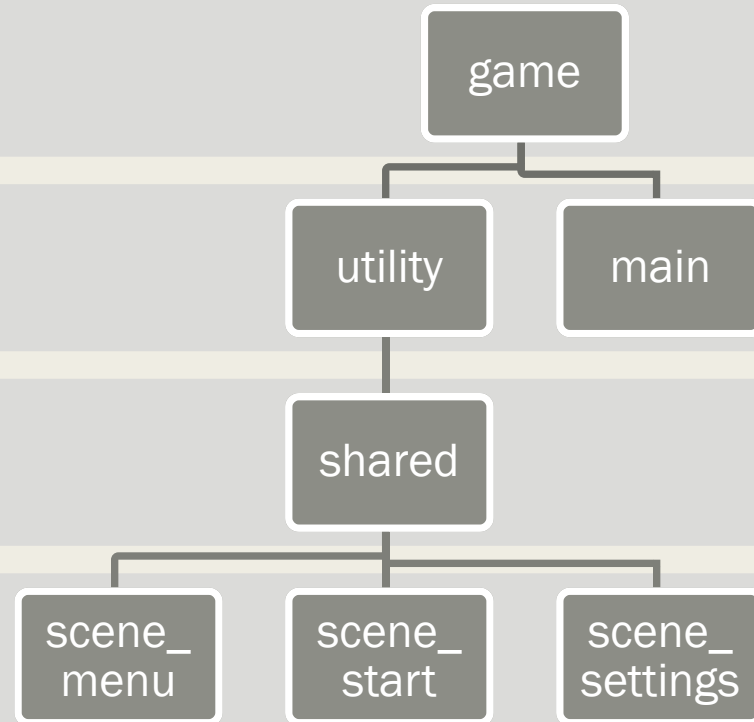
- If you want to use multiple files.

Allegro5 routines &
Scene control

Utility functions &
Entry point

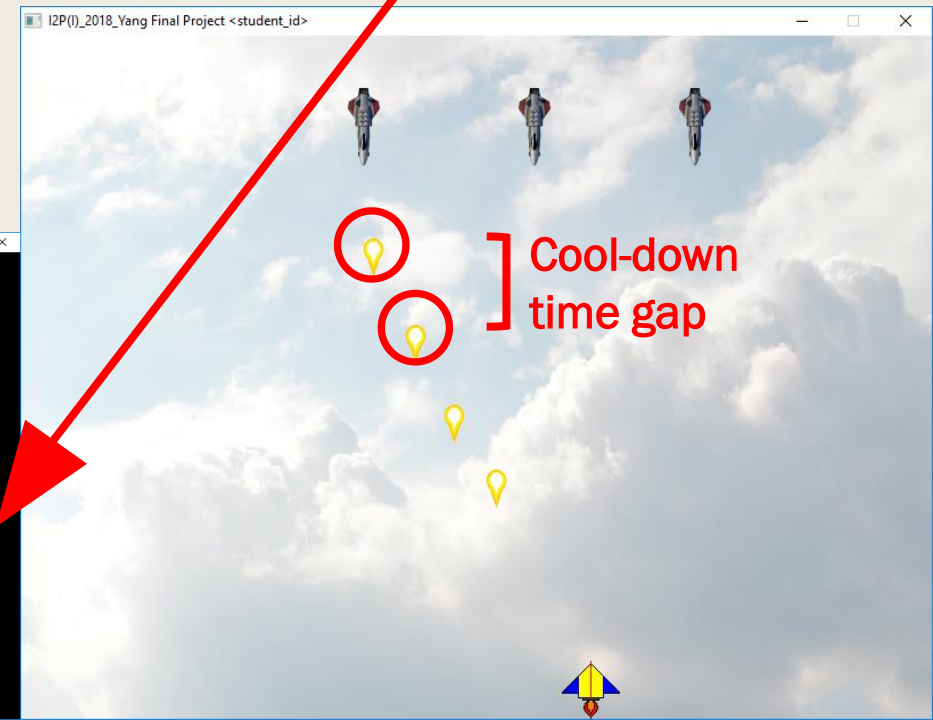
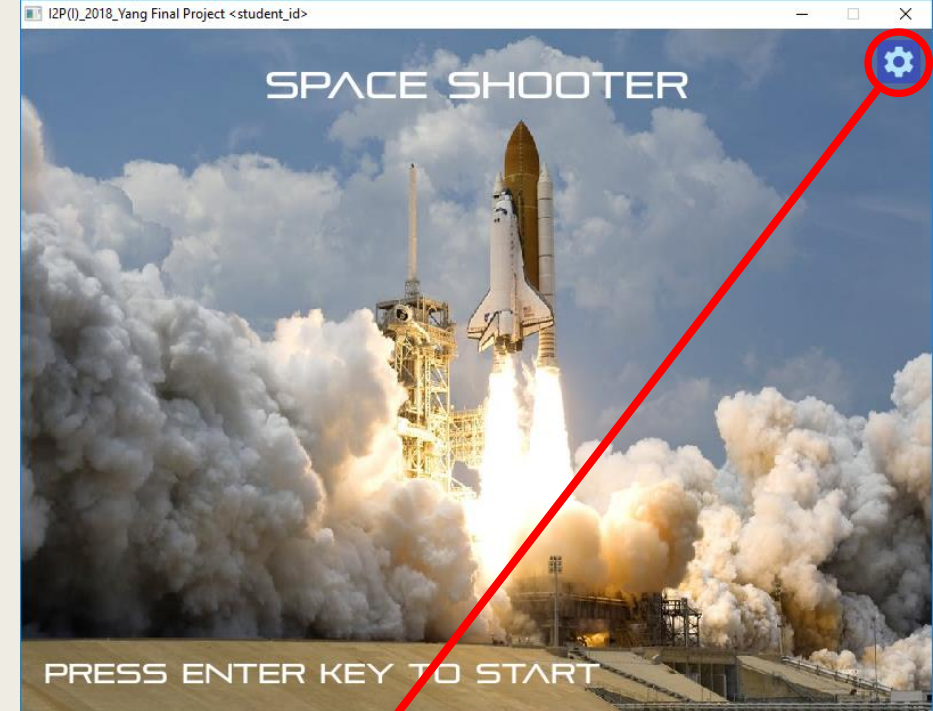
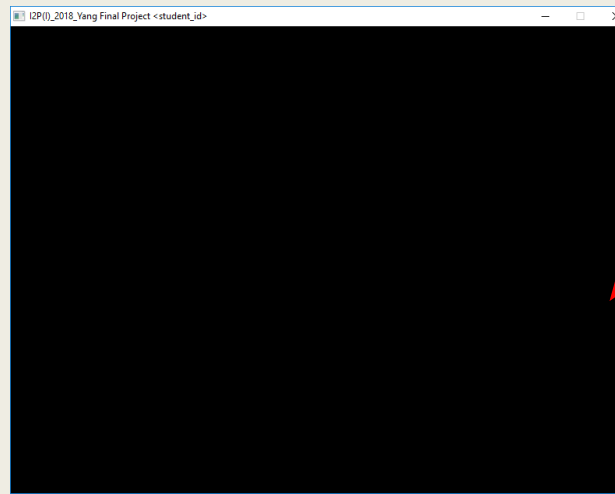
Shared resources

Scenes



Today 's Goal

- Setup boundaries for your airplane / rocket
- Shoot multiple bullets with cool-down
- Implement a new scene
 - *Create the settings scene.
(can be entirely black with no functions)*
 - *A button in main scene. (w/ mouse in/out animation)*



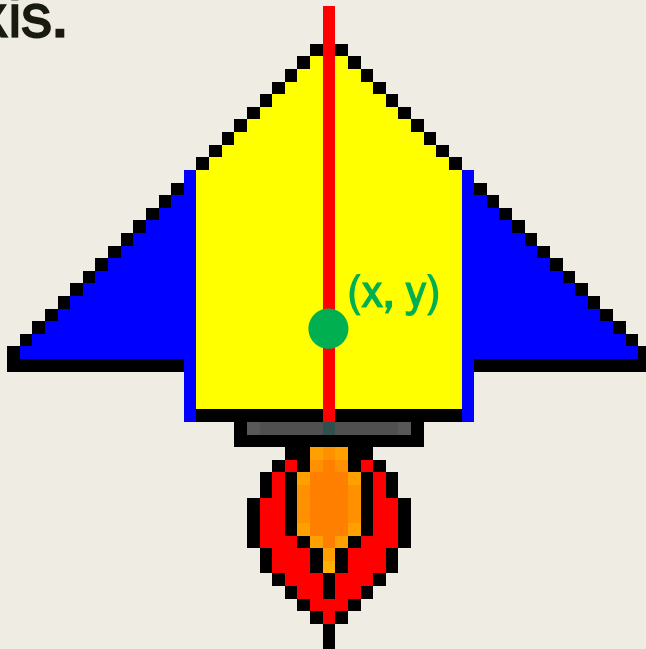
Today 's Goal (Example)

- For today's goal, you only need to uncomment the codes and replace the “???” with the correct code.

```
// [HACKATHON 1-1]
// TODO: Limit the plane's collision box inside the frame.
// (x, y axes can be separated.)
// Uncomment and fill in the code below.
//if (??? < 0)
// plane.x = ???;
//else if (??? > SCREEN_W)
// plane.x = ???;
//if (??? < 0)
// plane.y = ???;
//else if (??? > SCREEN_H)
// plane.y = ???;
```

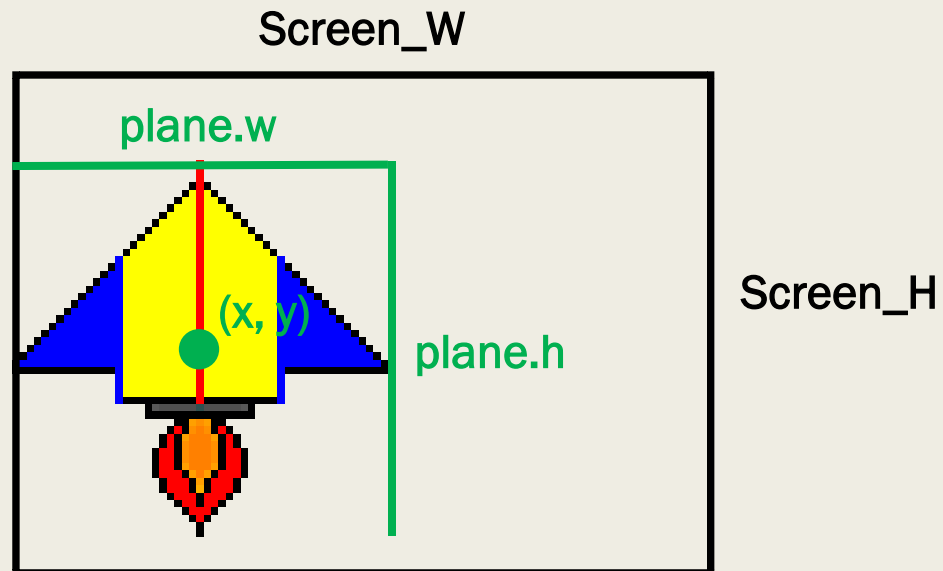
Today 's Goal (I)

- Setup boundaries for your airplane / rocket
- [HACKATHON] 1-1 ~ 1-1
- Separate the x and y axes. Use the same calculation to detect each axis.



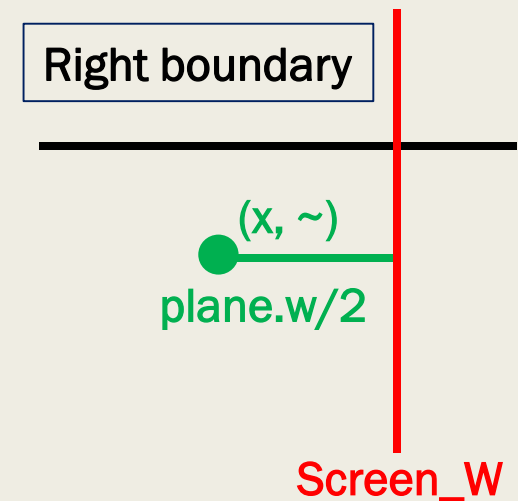
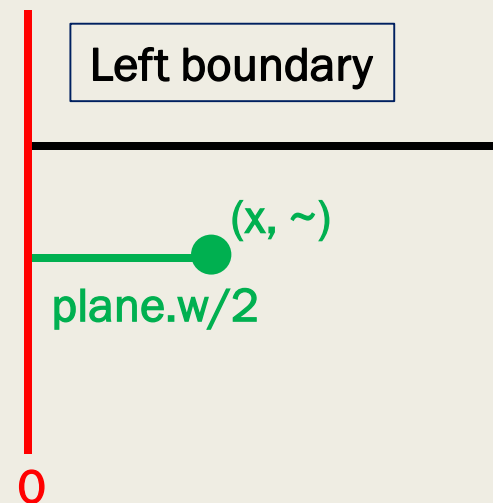
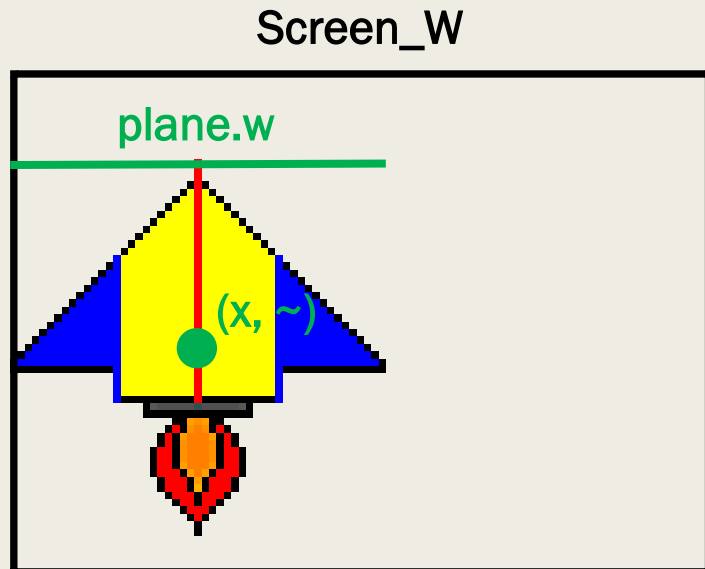
Today 's Goal (I)

- Setup boundaries for your airplane / rocket
- [HACKATHON] 1-1 ~ 1-1
- Separate the x and y axes. Use the same calculation to detect each axis.



Today 's Goal (I)

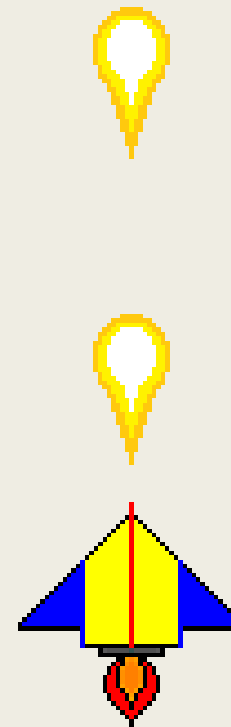
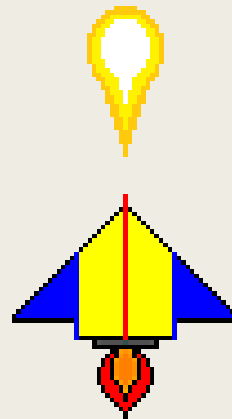
- Setup boundaries for your airplane / rocket
- Separate the x and y axes. Use the same calculation to detect each axis.
- Left bound and right bound for x-axis.



Today 's Goal (II)

- Shoot multiple bullets with cool-down
- [HACKATHON] 2-1 ~ 2-10
- Create a bullet array and reuse them.
- Control the time between bullet shoots

Bullets (h for hidden)



Cool-down
time gap
(e.g. 0.2 secs)

Today 's Goal (III)

- Implement a new scene
 - *Create the settings scene. (can be entirely black with no functions)*
 - *A button in main scene. (with mouse in/out animation)*
- [HACKATHON] 3-1 ~ 3-9

In `game_change_scene`, `game_update`, `game_draw`, `on_key_down`, ...

```
if (active_scene == SCENE_MENU) {  
    //...  
} else if (active_scene == SCENE_START) {  
    //...  
} else if (active_scene == SCENE_SETTINGS) {  
    //...  
}
```

Today 's Goal

- Aside from filling the blanks, make sure you understand the entire game flow and how each code section works.
- Find a TA and demo the 3 goals to get 0.5% bonus score.
- The TA will ask you to explain how the 3 goals are implemented, you'll get 0.5% bonus score if you can describe how the code works.

Useful Resource

- Allegro 5 Wiki
 - <https://www.allegro.cc/manual/5/>
- Allegro 5 reference manual
 - <https://liballeg.org/a5docs/trunk/>
- Movie Tutorial
 - <https://www.youtube.com/watch?v=IZ2krJ8Ls2A&list=PL6B459AAE1642C8B4>
- 2D Game Development Course
 - <http://fixbyproximity.com/2d-game-development-course/>

DON'T
CHEAT



LET 'S CODE

Have a nice day~