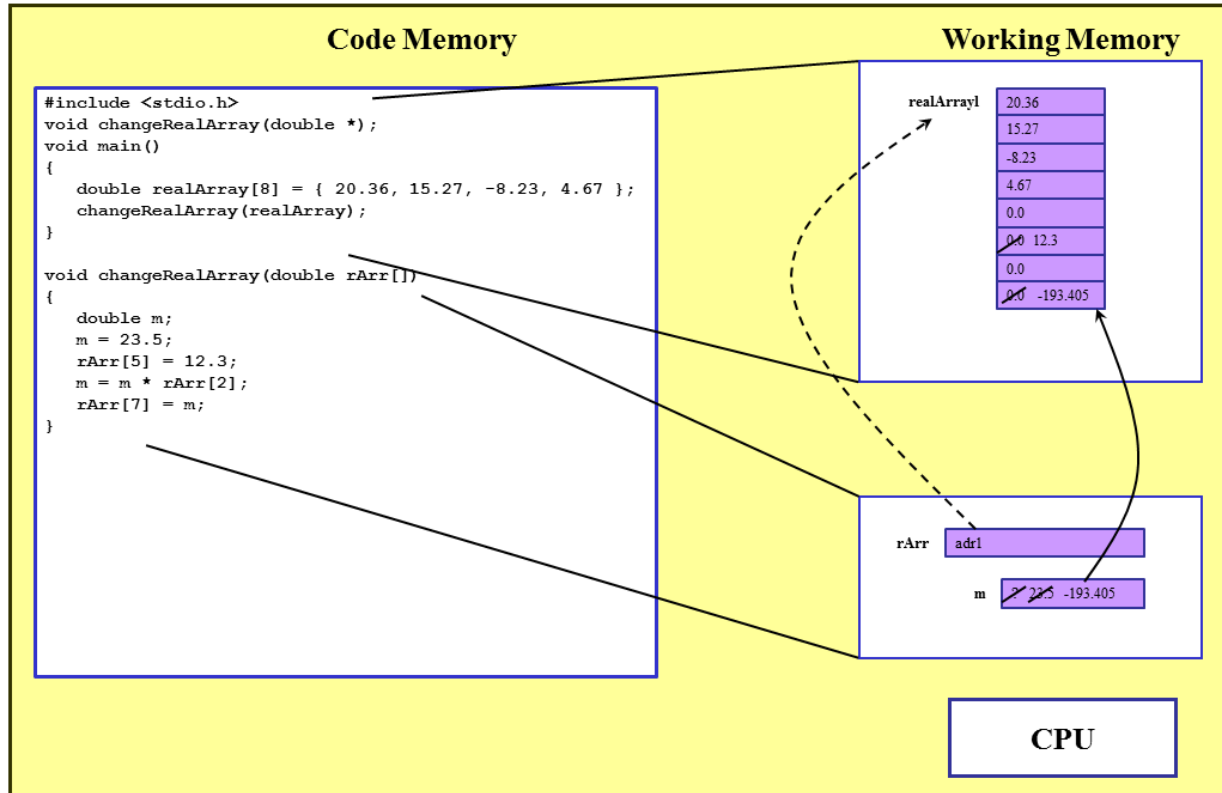


# GNG1106 Fall 2017 - Assignment 4 Solution

Deduct 0 to 5 points for not submitting assignment according to instructions (in a zip file, directory, with source code, etc.)

## Question 1 (10 marks)

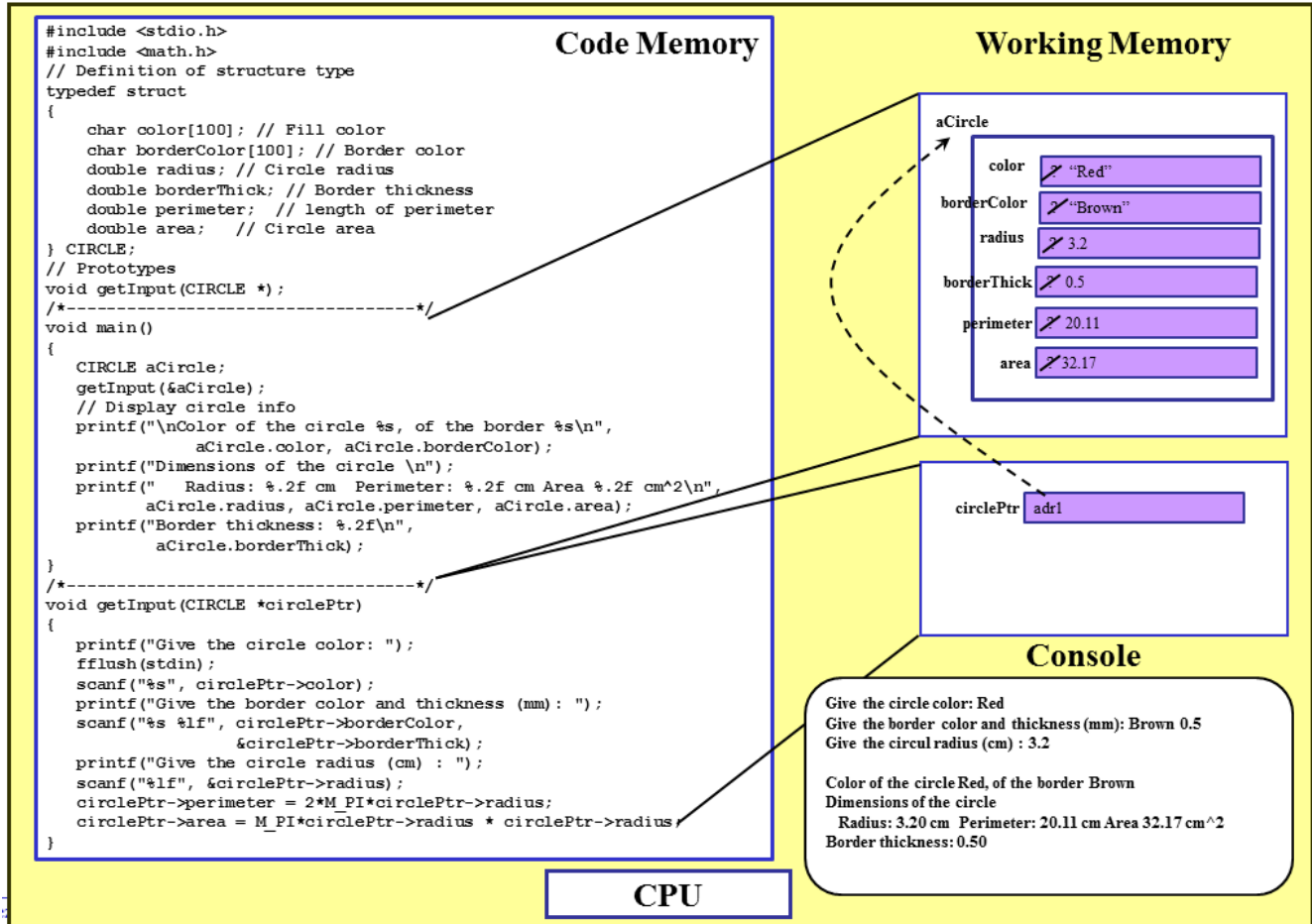
(a) (5 marks)



### Marking Scheme:

Defining and initialization of the array in memory	1 marks
0.25 for properly creating the array in memory.	
0.4 for four elements (0.1/value), 0.35 for zeros in last element	
-0.5 if 8 elements are not present (ex. only 5 elements)	
Defining double pointer and its reference to the array	1 mark
0.5 for the pointer variable	
0.5 for the reference (adr1 with dashed arrow)	
Deduct -0.25 for including ? in pointer value	
Defining variables m in memory with values	1 mark
0.25 for drawing variable m,	
0.75 for values (0.25 for each value ?/23.5/-193.405)	
Results for each assignment operation to array elements	2 marks
1.0 for instruction updating rArr[5]	
1.0 for instruction updating rArr[7]	
-0.5 if arrow showing that m is copied is missing.	
Total	5 marks

(b) (5 marks)



Marking Scheme:

- Variables in working memory for main 2 marks
  - 1.0 for drawing structure variable (0.1 for each member and 0.4 for aCircle box)
  - 1.0 for values (0.1 for correct values in the members and 0.4 for ? in aCircle members.)
  - The char arrays can also be represented as character array with a character in each element.
- Variables in working memory for function getInput 1 marks
  - 0.5 point for circlePtr pointer variable
  - 0.5 point for adr1 value and dashed arrow showing reference
- Console Output 2 marks
  - 1 for input/output due to getInput function (first 3 lines)
  - 0.5 for color output
  - 0.5 for dimensions output (last 3 lines).
  - 0.5 if blank line is missing
  - 0.5 if format in second last line not correct (should display 2 numbers in fractional part).

Total

5 marks

## Question 2 (15 marks)

```
/*-----  
File: rocketSpeed.c  
Description: Computes the speed of a selected rocket at a given time t.  
-----*/  
  
#include <stdio.h>  
#include <math.h>  
// Symbolic constant  
#define G 9.81  
// Structure Type  
typedef struct  
{  
    char name[100];  
    double u; // speed of ejected fuel  
    double m0; // initial mass  
    double q; // rate of fuel consumption.  
} ROCKET;  
// Function Prototype  
int selectRocket(ROCKET *);  
double computeSpeed(double, ROCKET);  
/*-----  
Function: main  
Description: Initialises the array of structures. Requires from the user  
a selection of one of the rockets using the selectRocket function.  
Then requests from the user a value of time. Calls the function  
computeSpeed to calculate the speed of the rocket selected at the  
given time. Displays results.  
-----*/  
  
void main(void)  
{  
    // Déclarations du tableau de fusées  
    ROCKET rockets[4] =  
    {  
        {"Rocket 1", 2000.0, 150000.0, 2700.0},  
        {"Rocket 2", 1596.0, 300000.0, 5367.0},  
        {"Rocket 3", 3267.0, 543135.0, 8900.0},  
        {"Rocket 4", 984.0, 5468.0, 89.5}  
    };  
    // Other variables  
    double v, t; // speed v of rocket at time t  
    int ixr; // index of selected rocket  
    // Input  
    ixr = selectRocket(rockets);  
    printf("Give the time t (s): ");  
    scanf("%lf", &t);  
    // Compute speed  
    v = computeSpeed(t, rockets[ixr]);  
    // Le résultat  
    printf("Selected rocket:\n");  
    printf("    Name: %s\n", rockets[ixr].name);  
    printf("    Speed of fuel u: %.2f m/s\n", rockets[ixr].u);  
    printf("    Initial mass m0: %.2f kg\n", rockets[ixr].m0);  
    printf("    Rate of fuel consumption: %.2f kg/s\n", rockets[ixr].q);  
    printf("After %.2f secondes, the speed v of the rocket is %.3f m/s\n",  
        t, v);  
}
```

```

/*-----
Function: selectRocket
Parameters:
    rockets - array of ROCKET structures (this is a pointer)
Return: Index of selected rocket.
Description: Displays the contents of the array, asks the user to select
             a rocket (1 to 4).
-----*/
int selectRocket(ROCKET rockets[])
{
    int rNumber; // rocket number selected
    printf("%s: u = %.2f m0 = %.2f q = %.2f\n",
           rockets[0].name, rockets[0].u,
           rockets[0].m0, rockets[0].q);
    printf("%s: u = %.2f m0 = %.2f q = %.2f\n",
           rockets[1].name, rockets[1].u,
           rockets[1].m0, rockets[1].q);
    printf("%s: u = %.2f m0 = %.2f q = %.2f\n",
           rockets[2].name, rockets[2].u,
           rockets[2].m0, rockets[2].q);
    printf("%s: u = %.2f m0 = %.2f q = %.2f\n",
           rockets[3].name, rockets[3].u,
           rockets[3].m0, rockets[3].q);
    printf("Please select a rocket (1 to 4): ");
    scanf("%d", &rNumber);
    rNumber = rNumber - 1; //convert to array index
    return(rNumber);
}
/*-----
Function: computeSpeed
Parameters:
    t - time in secondes
    rocket - structure variable that gives rocket characteristics.
Returns: Speed of the rocket at time t.
Description: With the given data in the structure, compute the speed
             of the rocket at time t.
-----*/
double computeSpeed(double t, ROCKET rocket)
{
    // Declarations of variables
    double v; // rocket speed
    // Computation
    v = log(rocket.m0/(rocket.m0-rocket.q*t));
    v = rocket.u*v - G*t;
    return(v);
}

```

## Output

```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignments\A4\A4_Q2\bin\Debug\D4_Q2.exe
Rocket 1: u = 2000.00 m0 = 150000.00 q = 2700.00
Rocket 2: u = 1596.00 m0 = 300000.00 q = 5367.00
Rocket 3: u = 3267.00 m0 = 543135.00 q = 8900.00
Rocket 4: u = 984.00 m0 = 5468.00 q = 89.50
Please select a rocket (1 to 4): 1
Give the time t (s): 11.30
Selected rocket:
Name: Rocket 1
Speed of fuel u: 2000.00 m/s
Initial mass m0: 150000.00 kg
Rate of fuel consumption: 2700.00 kg/s
After 11.30 secondes, the speed v of the rocket is 343.952 m/s
```

```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignments\A4\A4_Q2\bin\Debug\D4_Q2.exe
Rocket 1: u = 2000.00 m0 = 150000.00 q = 2700.00
Rocket 2: u = 1596.00 m0 = 300000.00 q = 5367.00
Rocket 3: u = 3267.00 m0 = 543135.00 q = 8900.00
Rocket 4: u = 984.00 m0 = 5468.00 q = 89.50
Please select a rocket (1 to 4): 2
Give the time t (s): 31.20
Selected rocket:
Name: Rocket 2
Speed of fuel u: 1596.00 m/s
Initial mass m0: 300000.00 kg
Rate of fuel consumption: 5367.00 kg/s
After 31.20 secondes, the speed v of the rocket is 997.582 m/s

Process returned 63 (0x3F) execution time : 7.778 s
Press any key to continue.
```

```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignments\A4\A4_Q2\bin\Debug\D4_Q2.exe
Rocket 1: u = 2000.00 m0 = 150000.00 q = 2700.00
Rocket 2: u = 1596.00 m0 = 300000.00 q = 5367.00
Rocket 3: u = 3267.00 m0 = 543135.00 q = 8900.00
Rocket 4: u = 984.00 m0 = 5468.00 q = 89.50
Please select a rocket (1 to 4): 2
Give the time t (s): 45.60
Selected rocket:
Name: Rocket 2
Speed of fuel u: 1596.00 m/s
Initial mass m0: 300000.00 kg
Rate of fuel consumption: 5367.00 kg/s
After 45.60 secondes, the speed v of the rocket is 2252.531 m/s

Process returned 64 (0x40) execution time : 13.388 s
Press any key to continue.
```

```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignments\A4\A4_Q2\bin\Debug\D4_Q2.exe
Rocket 1: u = 2000.00 m0 = 150000.00 q = 2700.00
Rocket 2: u = 1596.00 m0 = 300000.00 q = 5367.00
Rocket 3: u = 3267.00 m0 = 543135.00 q = 8900.00
Rocket 4: u = 984.00 m0 = 5468.00 q = 89.50
Please select a rocket (1 to 4): 3
Give the time t (s): 15.20
Selected rocket:
Name: Rocket 3
Speed of fuel u: 3267.00 m/s
Initial mass m0: 543135.00 kg
Rate of fuel consumption: 8900.00 kg/s
After 15.20 secondes, the speed v of the rocket is 786.708 m/s

Process returned 63 (0x3F) execution time : 6.981 s
Press any key to continue.
```

```
D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignments\A4\A4_Q2\bin\Debug\D4_Q2.exe
Rocket 1: u = 2000.00 m0 = 150000.00 q = 2700.00
Rocket 2: u = 1596.00 m0 = 300000.00 q = 5367.00
Rocket 3: u = 3267.00 m0 = 543135.00 q = 8900.00
Rocket 4: u = 984.00 m0 = 5468.00 q = 89.50
Please select a rocket (1 to 4): 4
Give the time t (s): 0.12
Selected rocket:
Name: Rocket 4
Speed of fuel u: 984.00 m/s
Initial mass m0: 5468.00 kg
Rate of fuel consumption: 89.50 kg/s
After 0.12 secondes, the speed v of the rocket is 0.757 m/s

Process returned 60 (0x3C) execution time : 12.914 s
Press any key to continue.
```

Marking Scheme:

C Program	
Structure definition	1 mark
0.4 total: 0.1 for each member	
0.6 for <code>typedef struct { } ROCKET;</code>	
Main function (4.5 total marks))	
Comments (header)	0.5 mark
Declaration of variables	0.5 mark
Call to <code>selectRocket</code>	0.5 mark
Instructions for getting time value	0.5 mark
Call to <code>computeSpeed</code>	0.5 mark
Instructions to display the results	1 mark
Messages consisted with required output	0.5 mark
Proper formatting of numbers (number of digits in fractions)	0.5 mark
Function <code>selectRocket</code> (4.0 marks total)	
Comments (header)	0.5 mark
Function header/prototype	0.5 marks
Variable declaration	0.5 marks
Instructions to display menu to user	1 mark
scanf instruction to read value from user	0.5 mark
Calculation of index	0.5 mark
Return instruction	0.5 marks
Deduct -1 mark if any branching (if) instruction is used.	
Function <code>computeSpeed</code> (3 marks total)	
Comments (header)	0.5 mark
Function header/prototype	0.5 marks
Variable declaration	0.5 mark
Computation of speed	1 mark
Return statement	0.5 marks
Output (0.5 mark per output)	2.5 marks
Total	15 marks