ICS Homework 3

March 21, 2020

1 System Software

1.1 Fork and Execve

Read the C program and answer the questions below. NOTE: /bin/echo is an executable file that will print its arguments on the screen.

```c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/wait.h>

char *ch;

int main(void)
{
  ch = malloc(1);
  *ch = 'A';

  if (fork() == 0) {
    *ch = 'B';
    printf("%c\n", *ch);

    if (fork() == 0)
      printf("C\n");
    else
      exit(0);
  } else {
    while (waitpid(-1, NULL,
                   WUNTRACED) > 0);
    char *my_argv[] = {"/bin/echo", ch, 0};
    execve(my_argv[0], my_argv, 0);
    printf("D\n");
  }
  free(ch);
  return 0;
}
```

1. What is the possible output of this program? Is the output deterministic? Please explain why.

2. What if we print the address of `ch` in all processes? Will them the be same? Will their value be the same? Why?

```
/* same as before */
  ch = malloc(1);
  *ch = 'A';

  if (fork() == 0) {
    *ch = 'B';
    printf("%p:%c\n", ch, *ch);
    if (fork() == 0)
        *ch = 'C';
        printf("%p:%c\n", ch, *ch);
    else
        exit(0);
  } else {
        printf("%p:%c\n", ch, *ch);
    while (waitpid(-1, NULL,
        WUNTRACED) > 0);
/* same as before */
```

3. Is there any memory leakage or double free issue for the variable ch in each process? Please explain why.

2 Organization

2.1 Pipeline

1. Please write down the HCL code for the following signals in PIPE implementation. NOTE: You should refer to Chapter 4.5 of CSAPP book.

   a. `d_valB`

   b. `D_stall`

   c. `E_bubble`

2. What's the difference between signal `e_dstE` and `E_dstE`? When are they updated?