

Q1 (30 pts)	Q2 (35 pts)	Q3 (35 pts)	Sum

**Name:**

**No:**

**Signature:**

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**No questions allowed --- 45 mins. --- Page 1**

**Question 1:** (You will NOT receive any points for answers which are not explained.)

< Assume that required include files are included here >

```
#define COUNT 2
```

```
int main (void) {
    int i, f;

    for (i=0; i<COUNT; i++) {
        f=fork();
        if (f == -1) {
            printf("Error \n");
            exit(1);
        }
    }
    if (f==0) {
        printf("CHILD: Process id=%d, Parent Process id=%d\n", getpid(), getppid());
    }
    else {
        printf("PARENT: Process id=%d, Parent Process id=%d\n", getpid(),
            getppid());
        wait(NULL);
    }
    return (0);
}
```

**(1a)** Give an example output that will be printed when the above program is executed? Explain.

**(Note:** You can choose appropriate process id numbers for the processes).

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**No questions allowed --- 45 mins. --- Page 2**

**(1b) (i)** Modify the code given in the question in such a way that only 2 child processes are created, i.e. there will be a total of 3 processes including the initial process. Explain your modification.

**(ii)** Give an example output that will be printed when the modified code is executed? Explain.  
**(Note:** You can choose appropriate process id numbers for the processes).

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**No questions allowed --- 45 mins. --- Page 3**

**Question 2:** (You will NOT receive any points for answers which are not explained.)

< Assume that required include files are included here >

```
int main (void) {
    pid_t f;
    int *ptr = (int *) malloc (sizeof(int));

    *ptr=1;
    printf("Process id=%d, Parent Process id=%d, Adress=%p, Value=%d\n", getpid(),
           getppid(), ptr, *ptr);
    f=fork();
    if (f==-1) {
        printf("Error.\n");
        exit(1);
    }
    else {
        *ptr=*ptr+2;
        printf("Process id=%d, Parent Process id=%d, Adress=%p, Value=%d\n",
               getpid(), getppid(), ptr, *ptr);
        if (f!=0) {
            wait(NULL);
            printf("Process %d is now exiting...\n", getpid());
        }
        exit(0);
    }
    return(0);
}
```

Give an example output that will be printed when the above program is executed? Explain.

(**Note:** You can choose appropriate process id numbers and adress values if needed).

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**No questions allowed --- 45 mins. --- Page 4**

**Question 3:** (You will NOT receive any points for answers which are not explained.)

< Assume that required include files are included here >

```
int *ptr;

void *q2f(void *t) {
    long tid;

    *ptr=*ptr+2;
    tid= (long) t;
    printf("Process id=%d, Parent Process id=%d, Thread no= %ld Adress=%p,
           Value=%d\n", getpid(), getppid(), tid, ptr, *ptr);
    pthread_exit(NULL);
}

int main(void) {
    pthread_t threads[2];
    int r, i;

    ptr = (int *) malloc (sizeof(int));
    *ptr=0;
    for(i=0; i<2;i++) {
        r = pthread_create(&threads[i], NULL, q2f, (void *)i);
        if (r) {
            printf("Error.\n");
            exit(1);
        }
    }
    printf("Process id=%d, Parent Process id=%d --- %d threads created.\n",
           getpid(), getppid(), i);
    pthread_exit(NULL);
    return 0;
}
```

Give an example output that will be printed when the above program is executed? Explain.  
(**Note:** You can choose appropriate process id numbers and adress values if needed).