Introduction to Computer Science: Mid-sem 2, 2025–26

Model answers prepared for study; not an official university answer key.

1. UNIX commands

`cd directory` changes the current shell's working directory (for example, `cd /tmp`). `pwd` prints the working directory's path. `ls` lists directory entries; `ls -l` requests a detailed listing and `ls -a` includes names starting with a dot.

2. While and do-while

A `while` loop tests its condition before its body and can execute zero times. A `do-while` loop tests after its body and executes at least once. Both repeat while the controlling expression is nonzero. A semicolon is required after the final condition of `do-while`.

```
while (condition) { /* body */ }
do { /* body */ } while (condition);
```

The do-while structure is useful for a menu that must appear once before the user decides whether to repeat it. The while structure is useful for processing that must be skipped when the initial condition is false. Neither loop automatically changes its condition: the body must make progress where termination is required.

For an initial counter of 5 and condition `counter < 5`, a while body does not run, whereas a do-while body runs once before the failed test.

3. Declaration, definition and call

A declaration tells the compiler a function's name, return type and parameter types. Its definition supplies the executable body. A call evaluates arguments, passes their values and transfers control to that function; a return supplies the result.

```
int add(int a, int b);          /* declaration */
int add(int a, int b) {         /* definition */
    return a + b;
}
int main(void) {
    int result = add(2, 3);     /* call: result is 5 */
    return result != 5;
}
```

4. Compound interest program

For principal P, annual fractional rate r and duration n years, $A = P(1+r)^n$. Here $A = 50000(1.20)^2 =$ $\boxed{\text{72000 rupees}}$. A year-by-year check is

Year	Opening balance	Interest	Closing balance
1	50000	10000	60000
2	60000	12000	72000

The interest component is $72000 - 50000 = 22000$ rupees. The second year's interest is calculated on 60000, not the original 50000; this is why compound interest exceeds simple interest here. These results assume no intermediate repayments or extra charges. The program represents 20 percent by 0.20 and performs one multiplication per year.

```
#include <stdio.h>
int main(void) {
    const double principal = 50000.0;
    const double annual_rate = 0.20;
    const int years = 2;
    double amount = principal;
    for (int i = 0; i < years; ++i)
        amount *= 1.0 + annual_rate;
    printf("Total␣amount:␣Rs.␣%.2f\n", amount);
    return 0;
}
```

5. Operating system types

Batch systems execute queued jobs with little interactive input, as in classic mainframe batch processing. Time-sharing systems divide CPU time among interactive users (UNIX). Multitasking systems run multiple processes with scheduled access to resources (Linux or Windows). Real-time systems provide bounded timing for specified tasks (a suitably configured FreeRTOS embedded controller). Distributed systems coordinate networked machines as a system, whereas network operating systems expose services across machines (Windows Server is an example). Embedded operating systems serve dedicated devices. These categories overlap: one OS may be multiuser, multitasking and network-capable simultaneously.