C Programming - Complete Mid Exam Study Note

Bangla + English | Beginner University Level

Syllabus: Variable | Data Type | Operator | if-else | switch | for loop | while loop

Exam assumption: Total 40 marks | 3 sets | Answer any 2 sets

This note is exam-focused. Exact questions depend on your teacher and course outline.

Study method: Definition -> Bangla meaning -> Concept -> Syntax -> Example -> Program -> Input/Output -> Output tracing -> Practice.

1. Variable

1. Question: What is a variable in C? Give its syntax and example.

2. Definition / Direct Answer: A variable is a named memory location used to store a value. Its value may change during program execution.

3. Easy Bangla Meaning: Variable হলো memory-এর একটি named location যেখানে কোনো value রাখা যায়। Program চলার সময় সেই value পরিবর্তন করা যায়।

4. Important Concept: Variable ব্যবহার করার আগে তার data type এবং name দিতে হয়। যেমন বয়স রাখার জন্য age variable নিতে পারি।

5. Syntax:

```
data_type variable_name = value;
```

data_type = data-এর ধরন; variable_name = variable-এর নাম; = = value assign করা; value = যে data রাখা হবে।

6. Example: int age = 20; এখানে age-এর মধ্যে 20 রাখা হয়েছে।

7. Programming Example:

```
#include <stdio.h>
int main() {
    int age = 20;
    printf("%d", age);
    return 0;
}
```

Line-by-line explanation: #include <stdio.h> input/output-এর header. int main() program-এর starting function. int age = 20 variable declare ও initialize করে। printf value print করে। %d int print করার format specifier. return 0 program শেষ করে।

8. Input and Output:

```
Input: none
Output: 20
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- Declaration ভুল করা।

- Variable name-এ space দেওয়া।

- = এবং == গুলিয়ে ফেলা।

- Data type-এর সাথে incompatible value ব্যবহার করা।

10. Exam Tips: Declaration: data type + variable name. Initialization: প্রথম value দেওয়া। C variable name case-sensitive.

Exam-style programming question: What is a variable in C? Give its syntax and example.

11. Likely Questions:

[VERY HIGH] Define variable in C with example.

[VERY HIGH] Write a program to declare and print variables.

[HIGH] Differentiate declaration and initialization.

2. Data Type

1. Question: What is a data type in C? Explain int, float, double and char.

2. Definition / Direct Answer: A data type specifies the kind of value a variable can store and tells the compiler how to handle that value.

3. Easy Bangla Meaning: Data type বলে দেয় variable-এ কী ধরনের data থাকবে, যেমন integer, decimal বা character।

4. Important Concept: Beginner exam-এ int, float, double, char সবচেয়ে গুরুত্বপূর্ণ। একই variable-এর type অনুযায়ী value রাখতে হবে।

5. Syntax:

```
data_type variable_name;
```

int = পূর্ণ সংখ্যা; float = decimal; double = বেশি precision-এর decimal; char = single character.

6. Example: int marks=80; float price=12.5; double pi=3.14159; char grade='A';

7. Programming Example:

```
#include <stdio.h>
int main() {
    int marks = 80;
    float price = 12.5f;
    char grade = 'A';
    printf("%d %.1f %c", marks, price, grade);
    return 0;
}
```

Line-by-line explanation: int marks integer রাখে। float price decimal রাখে। char grade একটি character রাখে, তাই single quote ব্যবহার করা হয়েছে। %d = int, %.1f = 1 decimal place, %c = char.

8. Input and Output:

```
Input: none
Output: 80 12.5 A
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- char-এর জন্য "A" লেখা; সঠিক হলো 'A'.

- int variable-এ decimal রাখা।

- Format specifier ভুল দেওয়া।

10. Exam Tips: মনে রাখো: int -> %d, float -> %f, char -> %c. scanf-এ double-এর জন্য %lf commonly used.

Exam-style programming question: What is a data type in C? Explain int, float, double and char.

11. Likely Questions:

[VERY HIGH] Define data type.

[VERY HIGH] Explain int, float, double and char with examples.

[HIGH] Differentiate int and float.

3. Operator

1. Question: What is an operator in C? Explain arithmetic, relational, logical and assignment operators.

2. Definition / Direct Answer: An operator is a symbol that tells the compiler to perform a specific operation on one or more operands.

3. Easy Bangla Meaning: Operator হলো এমন symbol যা value বা variable-এর উপর কোনো operation করে।

4. Important Concept: Arithmetic calculation করে; relational comparison করে; logical multiple conditions combine করে; assignment value store/update করে।

5. Syntax:

```
operand1 operator operand2
```

operand = value/variable; operator = যে কাজটি করবে। যেমন a+b-তে a ও b operand, + operator.

6. Example: 10 + 3 = 13; 10 % 3 = 1; 5 > 3 is true.

7. Programming Example:

```
#include <stdio.h>
int main() {
    int a = 10, b = 3;
    printf("%d\n", a + b);
    printf("%d\n", a % b);
    printf("%d", a > b);
    return 0;
}
```

Line-by-line explanation: a+b addition করে 13। a%b remainder দেয়, তাই 1। a>b true হওয়ায় condition-এর integer representation হিসেবে 1 print হয়।

8. Input and Output:

```
Input: none
Output:
13
1
1
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- = এবং == গুলিয়ে ফেলা।

- % কে percentage ভাবা; C-তে এটি remainder.

- && এবং || এর meaning উল্টে ফেলা।

10. Exam Tips: Arithmetic: + - * / %. Relational: == != > < >= <=. Logical: && || !. Assignment: = += -= *= /=. Increment/Decrement: ++ --.

Exam-style programming question: What is an operator in C? Explain arithmetic, relational, logical and assignment operators.

11. Likely Questions:

[VERY HIGH] Explain types of operators with examples.

[VERY HIGH] Differentiate = and ==.

[HIGH] Find the output of an expression involving %, >, && or ||.

4. if-else

1. Question: What is if-else? Write a C program to check whether a number is even or odd.

2. Definition / Direct Answer: if-else is a decision-making statement. It executes one block when a condition is true and another block when the condition is false.

3. Easy Bangla Meaning: if condition true হলে if-এর block চলবে; condition false হলে else-এর block চলবে।

4. Important Concept: Program-এ decision নেওয়ার জন্য if-else ব্যবহার হয়। Condition সাধারণত relational/logical operator দিয়ে লেখা হয়।

5. Syntax:

```
if (condition) { statements; } else { statements; }
```

if = condition check; condition true হলে if block; else = condition false হলে alternative block.

6. Example: n % 2 == 0 হলে number even; না হলে odd.

7. Programming Example:

```
#include <stdio.h>
int main() {
    int n;
    scanf("%d", &n);
    if (n % 2 == 0)
        printf("Even");
    else
        printf("Odd");
    return 0;
}
```

Line-by-line explanation: scanf user-এর integer input নেয়। &n n-এর address দেয়। n%2 remainder বের করে। remainder 0 হলে even, otherwise odd.

8. Input and Output:

```
Input: 7
Output: Odd

Input: 8
Output: Even
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- if condition-এ = ব্যবহার করা।

- scanf-এ &n বাদ দেওয়া।

- if-এর পরে ভুল করে semicolon দেওয়া।

10. Exam Tips: Even/Odd, Positive/Negative/Zero, Largest of 2/3, Grade - এগুলো অবশ্যই practice করবে.

Exam-style programming question: What is if-else? Write a C program to check whether a number is even or odd.

11. Likely Questions:

[VERY HIGH] Even/Odd using if-else.

[VERY HIGH] Positive/Negative/Zero.

[VERY HIGH] Largest of two numbers.

[HIGH] Largest of three numbers.

[HIGH] Grade using if-else.

5. switch

1. Question: What is a switch statement? Explain case, break and default with a calculator example.

2. Definition / Direct Answer: switch is a selection statement used to execute one block from several possible cases based on the value of an expression.

3. Easy Bangla Meaning: একটি value-এর ভিত্তিতে অনেকগুলো fixed option-এর মধ্যে একটি choose করতে switch ব্যবহার করা হয়।

4. Important Concept: switch expression-এর value একটি case-এর সাথে match করে। match হলে সেই case চলে। break সাধারণত switch থেকে বের করে; default কোনো case match না হলে চলে।

5. Syntax:

```
switch(expression) { case value: statements; break; default: statements; }
```

switch = value check; case = possible value; break = switch থেকে বের হওয়া; default = no match হলে.

6. Example: choice=1 -> add, choice=2 -> subtract, choice=3 -> multiply.

7. Programming Example:

```
#include <stdio.h>
int main() {
    int a, b, choice;
    scanf("%d%d", &a, &b);
    scanf("%d", &choice);
    switch (choice) {
        case 1: printf("%d", a + b); break;
        case 2: printf("%d", a - b); break;
        case 3: printf("%d", a * b); break;
        default: printf("Invalid choice");
    }
    return 0;
}
```

Line-by-line explanation: choice-এর value অনুযায়ী case select হয়। break থাকায় matching case-এর পর switch শেষ হয়।

8. Input and Output:

```
Input:
10 5
1
Output: 15
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- case-এর পরে colon : ভুলে যাওয়া।

- break ভুলে যাওয়া, যার ফলে fall-through হতে পারে।

- default ভুলে যাওয়া যখন no-match handling দরকার।

10. Exam Tips: case, break, default তিনটি must remember. Calculator ও day/menu program practice করো.

Exam-style programming question: What is a switch statement? Explain case, break and default with a calculator example.

11. Likely Questions:

[VERY HIGH] Define switch and explain case/break/default.

[VERY HIGH] Calculator using switch.

[HIGH] Day name using 1-7.

6. for Loop

1. Question: What is a for loop? Write a program to print 1 to N and calculate their sum.

2. Definition / Direct Answer: A for loop repeatedly executes a block of statements while its condition is true. It is useful when repetition is controlled by a counter.

3. Easy Bangla Meaning: একই কাজ বারবার করার জন্য for loop ব্যবহার হয়। শুরু, condition ও update এক জায়গায় থাকে।

4. Important Concept: প্রথমে initialization, তারপর condition check; true হলে body execute; তারপর update; আবার condition check. এভাবে loop চলে।

5. Syntax:

```
for (initialization; condition; update) { statements; }
```

initialization = শুরু value; condition = কতক্ষণ চলবে; update = counter কত করে change হবে.

6. Example: for(i=1; i<=5; i++) print করলে 1 2 3 4 5 পাওয়া যায়.

7. Programming Example:

```
#include <stdio.h>
int main() {
    int n, i, sum = 0;
    scanf("%d", &n);
    for (i = 1; i <= n; i++) {
        printf("%d ", i);
        sum += i;
    }
    printf("\nSum = %d", sum);
    return 0;
}
```

Line-by-line explanation: i=1 থেকে শুরু। i<=n true যতক্ষণ, number print এবং sum update হয়। প্রতি iteration-এ i++ এক করে বাড়ায়.

8. Input and Output:

```
Input: 5
Output:
1 2 3 4 5
Sum = 15
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- i++ ভুলে যাওয়া।

- < এবং <= গুলিয়ে ফেলা।

- sum=0 initialize না করা।

10. Exam Tips: Syntax মুখস্থ: for(init; condition; update). 1-N, sum, table, factorial, even numbers practice করো.

Exam-style programming question: What is a for loop? Write a program to print 1 to N and calculate their sum.

11. Likely Questions:

[VERY HIGH] Print 1 to N.

[VERY HIGH] Sum 1 to N.

[VERY HIGH] Multiplication table.

[VERY HIGH] Factorial using for.

[HIGH] Even numbers in a range.

7. while Loop

1. Question: What is a while loop? Write a program to print 1 to N.

2. Definition / Direct Answer: A while loop repeatedly executes a block of statements as long as its condition is true.

3. Easy Bangla Meaning: while loop আগে condition check করে। condition true হলে body চলে; false হলে loop বন্ধ হয়।

4. Important Concept: while-এ initialization এবং update আলাদা করে লিখতে হয়। Update ভুলে গেলে loop infinite হতে পারে।

5. Syntax:

```
while (condition) { statements; }
```

while = condition first. condition true হলে body; counter update না করলে loop থামবে না.

6. Example: i=1; while(i<=5) print i and i++ -> 1 2 3 4 5.

7. Programming Example:

```
#include <stdio.h>
int main() {
    int n, i = 1;
    scanf("%d", &n);
    while (i <= n) {
        printf("%d ", i);
        i++;
    }
    return 0;
}
```

Line-by-line explanation: i=1 দিয়ে শুরু। condition true হলে print হয়। i++ counter বাড়ায়। n=5 হলে i=6-এর সময় condition false হয়ে loop শেষ।

8. Input and Output:

```
Input: 5
Output: 1 2 3 4 5
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- i++ ভুলে যাওয়া।

- while-এর পরে unnecessary semicolon দেওয়া।

- i initialize না করা।

10. Exam Tips: while = condition first. Digit sum-এর মতো problem-এ while খুব useful.

Exam-style programming question: What is a while loop? Write a program to print 1 to N.

11. Likely Questions:

[VERY HIGH] Define while loop with syntax.

[VERY HIGH] Print 1 to N using while.

[HIGH] Sum/factorial using while.

[HIGH] Sum of digits using while.

8. Loop + Condition: Basic Important Programs

1. Question: Write C programs for factorial, sum of digits, and printing even numbers using loops.

2. Definition / Direct Answer: A loop can be combined with conditions and arithmetic operations to solve repeated problems efficiently.

3. Easy Bangla Meaning: Loop repeated কাজ করে আর if decision নেয়। দুটো একসাথে ব্যবহার করে অনেক common exam problem solve করা যায়।

4. Important Concept: Factorial-এ repeated multiplication; digit sum-এ repeated remainder/division; even numbers-এ each number-এর condition check করা হয়.

5. Syntax:

```
for/while { if (condition) { ... } ... }
```

Loop-এর body-এর ভিতরে if লিখে repeated condition check করা যায়।

6. Example: 5! = 1×2×3×4×5 = 120. 123 -> digit sum = 1+2+3 = 6.

7. Programming Example:

```
/* Factorial */
#include <stdio.h>
int main() {
    int n, i, fact = 1;
    scanf("%d", &n);
    for (i = 1; i <= n; i++)
        fact *= i;
    printf("%d", fact);
    return 0;
}

/* Sum of digits */
#include <stdio.h>
int main() {
    int n, digit, sum = 0;
    scanf("%d", &n);
    while (n > 0) {
        digit = n % 10;
        sum += digit;
        n = n / 10;
    }
    printf("%d", sum);
    return 0;
}
```

Line-by-line explanation: Factorial-এ fact=1 দিয়ে শুরু করতে হয়, কারণ multiplication-এর identity 1। Digit sum-এ n%10 last digit দেয় এবং n/10 last digit বাদ দেয়।

8. Input and Output:

```
Factorial input: 5
Output: 120

Digit sum input: 123
Output: 6
```

Output tracing question: Find the output of a short program from this topic and trace each step.

9. Common Exam Mistakes:

- fact=0 দিয়ে শুরু করা।

- Digit sum-এ n%10 ভুলে যাওয়া।

- n=n/10 না করলে while থামবে না।

10. Exam Tips: n! = 1×2×...×n; 0! = 1. Digit sum: digit=n%10, n=n/10.

Exam-style programming question: Write C programs for factorial, sum of digits, and printing even numbers using loops.

11. Likely Questions:

[VERY HIGH] Factorial using for.

[VERY HIGH] Sum of digits using while.

[HIGH] Print even numbers using loop + if.

Important Comparison Table

Topic	Meaning / Difference
=	Assignment - variable-এ value রাখে.
==	Equality comparison - দুই value সমান কিনা check করে.
if-else	Condition-based decision: true/false block.
switch	Fixed cases-এর মধ্যে selection.
for	Initialization, condition, update এক syntax-এ থাকে.
while	Condition first; initialization/update আলাদা করে লিখতে হয়.
%	Remainder operator.
&&	AND - সব condition true হতে হয়.
||	OR - অন্তত একটি condition true.
!	NOT - logical opposite.

Programming Output Practice

Question: Find the output.

```
int x = 5;
if (x > 3)
    printf("A");
else
    printf("B");
```

Correct Output: A

Trace: x=5 -> 5>3 is true -> if block runs -> A prints. Else does not run.

Question: Find the output.

```
int i;
for(i=1; i<=3; i++)
    printf("%d ", i);
```

Correct Output: 1 2 3

Trace: i=1, 2, 3 print হয়; i=4 হলে condition false হয়.

FINAL EXAM PRIORITY

MUST STUDY: Variable declaration/initialization; int, float, double, char; arithmetic, relational, logical and assignment operators; if-else programs; switch-case; for loop; while loop; output tracing.

SHOULD STUDY: Nested if, &&/||, even numbers in a range, loop + if, switch day/menu.

IF TIME REMAINS: More complex patterns and uncommon variations. Exact emphasis depends on your teacher.

40-Mark Probable Practice Sets

Set A: 1. (10) Define variable and data type; explain int, float, double, char with examples. 2. (10) Explain arithmetic, relational and logical operators with examples and output tracing. 3. (20) Write programs: Even/Odd and Largest of three.

Set B: 1. (10) Explain if-else with syntax and example. 2. (10) Explain switch, case, break, default. 3. (20) Write calculator using switch and grade using if-else.

Set C: 1. (10) Explain for loop with syntax and example. 2. (10) Explain while loop and compare for vs while. 3. (20) Write programs: Sum 1-N, Factorial, and Table or Digit Sum.

These are realistic practice sets, not the exact question paper.

Last-Minute Revision Sheet

Definitions: Variable = named memory location for storing a value. Data type = specifies the type of value a variable can store. Operator = symbol that performs an operation. if-else = decision statement. switch = multi-case selection statement. for/while = repetition statements.

Core Syntax:

```
int x = 10;
if(condition) { ... } else { ... }
switch(x) { case 1: ...; break; default: ...; }
for(i=1; i<=n; i++) { ... }
while(i<=n) { ...; i++; }
```

Operators: + - * / % | == != > < >= <= | && || ! | = += -= *= /= | ++ --

Must-practice programs: Even/Odd; Positive/Negative/Zero; Largest 2/3; Grade; Calculator using switch; 1-N; Sum 1-N; Table; Factorial; Digit Sum; Even numbers using loop + if.

Golden rules: = means assignment; == means comparison; % gives remainder; scanf normally needs & before an ordinary variable; char uses single quotes; switch cases commonly use break; loops need initialization, condition, and update.