מבחן בקורס "טרנספורמציה לשיפור איכות קוד קיים" – תשע"ה

מרצה: ד"ר רן אטינגר. מספר קורס: 0368331601

___________________
מספר זהות
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מספר מחברת:
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<th>תשובה (להקיף בעיגול)</th>
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</tbody>
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ציון בחינה: _______________________

הוראות:

א) יש להקיף בעיגול תשובה אחת لكل שאלה, ובכל שאלה, קונדור שלמה.
ב) כולם חסרים כמות חכמה ב-4 נקודות (כפולה 25 שאלות = 100 נקודות).
ג) המבחין בוחן פותח (מלבד עזרי אלקטרוניים).
ד) המבחן משמשם ליתיות ולא תיבר. את התשובות יש להכתב בעומד זה בלבד.
ה) מישר הבחייה 3 שעות.

בהצלחה!
The questions in the entire exam refer to the following code example:

```java
public class WordCounter {

    int chars, words, lines;

    void count(char[] input) {
        int nl = 0;
        int nc = 0;
        int nw = 0;
        boolean inword = false;
        while (nc < input.length) {
            int c = input[nc];
            nc++;
            if (c == '\n')
                nl++;
            if (c == ' ' || c == '\n' || c == '\t')
                inword = false;
            else if (!inword) {
                inword = true;
                nw++;
            }
        }
        lines = nl;
        words = nw;
        chars = nc;
    }
    ...
}
```

**Question 1:** Which of the following keywords is used in the following line?

```java
1. boolean inword = false;
2. while (nc < input.length) {
3. int c = input[nc];
4. if (c == '\n')
5.    nl++;
```

1. a
2. b
3. c
4. d

**Question 2:** Which of the following Keywords is used in the following line?

```java
1. while (nc < input.length) {
2.     int c = input[nc];
3.     nc++;
4.     if (c == '\n')
5.         nl++;
```

1. a
2. b
3. c
4. d
3. Which of the following pairs of numbers does not represent a string in the CFG?
   (10,5) . a
   (11,5) . b
   (12,5) . c
   (14,5) . d

4. Which of the following numbers is not a postdominator of number 7?
   6 . a
   9 . b
   10 . c
   12 . d

5. Determine which of the following statements justify the fact that number 9 is not directly dependent on number 5 in the PDG?
   a. Number 9 is not postdominator of number 5 and 15.
   b. Number 9 is not postdominator of number 6.
   c. Number 9 is postdominator of number 6 and 15.
   d. Number 9 is postdominator of number 8.

6. Which of the following paths of the CFG are possible flow dependence paths?
   a. (12,13)
   b. (13,14,5,6,7,8,10,11)
   c. (13,14,5,6,7,8,10,11,15,6,7,8,10,12)
   d. (13,14,5,6,7,8,9,10,12)

7. Which of the following numbers is not directly dependent on number 7 in the PDG?
   4 . a
   11 . b
   12 . c
   13 . d

8. Which of the following numbers is not directly dependent on number 11 in the CFG flow anti data dependence?
   a. 4
   b. 11
   c. 12
   d. 13
9. What is the set of codepoints representing Slide 9 (column code 9 plus all codepoints before and after) control or flow? (direct or indirect)
   \{Entry, 8, 9\} \cdot a
   \{Entry, 5, 8, 9\} \cdot b
   \{Entry, 6, 7, 8, 9\} \cdot c
   \{Entry, 5, 8, 9, 10, 12\} \cdot d

10. Which of the ordered pairs below forms a directed graph slide dependence graph (Slide dependence) sliding window control or flow (flow dependence) sliding window control or flow (flow dependence) sliding window control or flow (flow dependence) sliding window control or flow (flow dependence) sliding window control or flow (flow dependence) sliding window control or flow (flow dependence)?
   \(a\) \cdot (1, 3, 4)
   \(b\) \cdot (1, 3, 6)
   \(c\) \cdot (1, 3, 7)
   \(d\) \cdot (1, 3, 9)

11. Which of the codepoints 1 to 17 is the set of codepoints representing Slide 17 (column code 17 plus all codepoints before and after) flow or control? (direct or indirect)
   \{2, 7, 17\} \cdot a
   \{5, 7, 17\} \cdot b
   \{2, 5, 7, 17\} \cdot c
   \{2, 5, 6, 7, 17\} \cdot d
12. Which code segments represented by the following sets of nodes are \textit{SESE} (single-entry-single-exit) type in the \textit{CFG} (Control Flow Graph) of the input program? (Clavier)

(a) \{6,7,8\}  
(b) \{8,9,10\}  
(c) \{11,12,13,14\}  
(d) \{13,14\}

13. Complete the list of code segments in the top-down pass 1, consisting of 14 nodes, using the CFG for the \textit{CFG} (Control Flow Graph) of the input program. If there is no code at all, mark \textit{N} \textit{S} = \{1,9\} - \textit{S}\textit{coX}. List the sets of nodes \textit{X} (control data) and \textit{Y} (code) that result from the top-down pass 6.

(a) \text{X} = \{1,2,5,6,7,8,9\} \text{ Y} = \{8,9,10\} (control data) \text{ Y} = \{6,7,8,9\} (code)

14. The code segments represented by the top-down pass 1, consisting of 14 nodes, using the CFG for the input program. If there is no code at all, mark \textit{N} \textit{S} = \{2,3,4,5,6,7,10,11,12,13,14\} (representing the control data). List the sets of nodes \textit{X} (control data) and \textit{Y} (code) along with the \textit{coX} set.

(a) \text{X} = \{10,11,12,13,14\} \text{ Y} = \{2,3,4,9,10,11,12,13,14\}

15. Begin the bottom-up pass of the \textit{CFG} (Control Flow Graph). Complete the list of code segments in the bottom-up pass 1, consisting of 14 nodes, using the CFG for the input program. If there is no code at all, mark \textit{N} \textit{S} = \{7,8,9,10,11,12,13,14\} - \textit{S} (bottom-up). List the sets of nodes \textit{X} (control data) and \textit{Y} (code) along with the \textit{coX} set.

(a) \text{X} = \{6,8,9\} \text{ Y} = \{6,10,11,12,13,14\}

(b) \text{X} = \{6,8,9\} \text{ Y} = \{6,7,10,11,12,13,14\}

(c) \text{X} = \{6,7,8,9\} \text{ Y} = \{6,10,11,12,13,14\}

(d) \text{X} = \{6,7,8,9\} \text{ Y} = \{6,10,11,12,13,14\}
## Split Loop

In the context of Actiing for a set of commands marked as $M$ in the code block including the commands 1, 2, 3, 4, 18, 5, 6, 7, 8, 9 (considered base and extended), the following table illustrates:

<table>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>18</th>
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</tr>
</tbody>
</table>
```java
int nl = 0;
int nc = 0;
int nw = 0;
boolean inword = false;

while (nc2 < input.length) {
    int c = input[nc2];
    nc2++;
    if (c == '\n')
        nl++;
}
```

16. Which of the following constitutes a basis for the constraint 6 ≤ 7?

- a. This is a base constraint that results from a direct dependence of instruction 7 on instruction 6.
- b. This is an extended constraint due to constraints 6 ≤ 8, 9 ⇒ 8.
- c. This is an extended constraint due to constraints 8 ≤ 6, 9 ⇒ 8.
- d. This is an extended constraint due to constraints 5, 5 ≤ 7, 9 ⇒ 5.

17. Which of the following constitutes a basis for the constraint 6 ≤ 9?

- a. This is a base constraint that results from a direct dependence of instruction 9 on instruction 6.
- b. This is an extended constraint due to constraints 6 ≤ 8, 9 ⇒ 8, 9 ≤ 9, 9 ⇒ 5.
- c. This is an extended constraint due to constraints 6 ≤ 8, 9 ⇒ 8, 9 ⇒ 5, 9 ≤ 7.
- d. This is an extended constraint due to constraints 6 ≤ 8, 9 ⇒ 8, 9 ⇒ 5, 9 ≤ 7.

18. Laconic expression of a set of instructions in a bucket on instructions 1, 9, 6, 8:

- a. Before the set forced.
- b. Promoted to a marked bucket.
- c. Forced to a bucket after the instruction.
- d. Shabby shrewdly (arbitrary) before or after.

19. Laconic expression of a set of instructions in a bucket on instructions 1, 9, 6, 8:

- a. Before the set forced.
- b. Promoted to a marked bucket.
- c. Forced to a bucket after the instruction.
- d. Shabby shrewdly (arbitrary) before or after.

20. Laconic expression of a set of instructions in a bucket on instructions 1, 9, 6, 8:

- a. Before the set forced.
- b. Promoted to a marked bucket.
- c. Forced to a bucket after the instruction.
- d. Shabby shrewdly (arbitrary) before or after.
לקראת סיום, נעבור לסליידינג. כבסיס לסליידינג על קטע הקוד המורכב מהפקודות 1 עד 17atory נקבל את הייצוג הבא: קבוצת הקדקודים \( N \) היא \{Entry,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,Exit\} וקבוצה הקשתות \( E \) כוללת \( N \) \( C \). CDN: 8

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<th>Vars</th>
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<th>Kind</th>
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<td>Anti</td>
<td>{n1}</td>
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<td>Flow</td>
<td>{nc}</td>
<td>(9,9)</td>
<td>Flow</td>
<td>{n1}</td>
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<tr>
<td>(2,7)</td>
<td>Flow</td>
<td>{nc}</td>
<td>(9,15)</td>
<td>Flow</td>
<td>{n1}</td>
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<tr>
<td>(2,17)</td>
<td>Flow</td>
<td>{nc}</td>
<td>(10,6)</td>
<td>Anti</td>
<td>{c}</td>
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<td>(12,11)</td>
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<td>Flow</td>
<td>{chars}</td>
</tr>
<tr>
<td>(7,7)</td>
<td>Flow</td>
<td>{nc}</td>
<td></td>
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</tr>
</tbody>
</table>
 numeros novamente na sequência relevante:

```java
int nl = 0;
int nc = 0;
int nw = 0;
boolean inword = false;

while (nc < input.length) {
    int c = input[nc];
    nc++;
    if (c == '\n') nl++;
    if (c == ' ' || c == '\n' || c == '\t')
        inword = false;
    else if (!inword) {
        inword = true;
        nw++;
    }
}

lines = nl;
words = nw;
chars = nc;
```

Aqui estão os próximos três diagramas de fluxo:

21. Para a execução de slidão para `{\textit{nw}}=\{V\}`, adicione à Esq. 3-14 e à esq. 17-Entrada.

22. Para a execução de slidão para `{\textit{nc}}`, `{\textit{chars}}=\{V\}`, adicione aos cod. de entrada (`{\textit{nw}}`) a conjunto final `{\textit{NL}}`?

23. Para a execução de slidão para `{\textit{chars}, \textit{nc}}`, adicione à Esq. 3-14 e à esq. 2-7 e ao diagrama de fluxo `{\textit{chars}}` a conjunto final `{\textit{N}}`.

Para o código de entrada `{\textit{nw}}`?

Diagramas de fluxo:

- a. `{\textit{Entry, 2, 3, 4, 5, 6, 7, 10, 12, 14, Exit}}`
- b. `{\textit{Entry, 3, 4, 5, 6, 10, 11, 12, 13, 14, Exit}}`
- c. `{\textit{Entry, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, Exit}}`
- d. `{\textit{Entry, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 16, Exit}}`

Diagramas de fluxo:

- a. `{\textit{Entry, 1, 2, 3, 4, 5, 6, 7, 8, 9, 15, 16, 17, Exit}}`
- b. `{\textit{Entry, 1, 2, 5, 6, 7, 8, 9, 15, 17, Exit}}`
- c. `{\textit{Entry, 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, Exit}}`
- d. `{\textit{Entry, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, Exit}}`

Diagramas de fluxo:

- a. `{\textit{Entry, 17, Exit}}`
- b. `{\textit{Entry, 2, 5, 7, 17, Exit}}`
- c. `{\textit{Entry, 2, 5, 6, 7, 17, Exit}}`
- d. `{\textit{Entry, 2, 5, 6, 7, Exit}}`
24. באונת הפעולה של סליידינג עבור \( V = \{\text{chars}, nC\} \), מהו הקדקודים שירכיבו את הקוד המשלים (תחתיים) \( N_{cov} \) ?

\[
\begin{align*}
\text{a. } & \quad \{\text{Entry}, 1, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, \text{Exit}\} \\
\text{b. } & \quad \{\text{Entry}, 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, \text{Exit}\} \\
\text{c. } & \quad \{\text{Entry}, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, \text{Exit}\} \\
\text{d. } & \quad \{\text{Entry}, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, \text{Exit}\}
\end{align*}
\]

25. בביצוע של סליידינג עבור \( V = \{\text{lines}\} \) נקבל עבורה הקוד להיווק את הסלייס \( N_v = \{\text{Entry}, 1, 2, 5, 6, 7, 8, 9, 15, \text{Exit}\} \). באונת התמסורות מתכון המשלים את הקוד \( N_{cov} = \{\text{Entry}, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 16, 17, \text{Exit}\} \)?

\[
\begin{align*}
\text{a. } & \quad \text{אין בעיה כלל, \( \text{Pen1} = \text{Pen2} = \text{Pen3} = \{\} \)} \\
\text{b. } & \quad \text{ערך המשתנה הת-lnול של השטח \( nC \)-סלייס (הקבוצה \( \text{Pen1} \)) \( \text{אין ריקה} \)} \\
\text{c. } & \quad \text{קיים שימוש לקוד \( nC \)-סלייס של \( \text{Pen2} \) \( \text{אין ריקה} \)} \\
\text{d. } & \quad \text{סלייס עלול לשלוט גם ערכה של \( \text{Pen1} \) \( \text{אין ריקה} \)} \\
\text{e. } & \quad \text{סלייס \( \text{Pen3} \) \( \text{אין ריקה} \)}
\end{align*}
\]