



# השתלמות מקצועית בנושא תכנות בסיסי בשפת Python



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בעלים של שווי פנימי – מעריכי שווי בלתי תלויים  
מנכ"ל לשכת מעריכי השווי והאקטוארים הפיננסיים בישראל (IAVFA)

תל אביב, 2 בינואר 2020



# 1. מבוא

בואו ללמוד איך עורכים בוויקיפדיה. הסדנה תתקיים בספרייה הלאומית בירושלים ביום שישי, 03.01.20, בשעה 09:00. להרשמה לחצו כאן.

[הסתרה]

## פייתון

ערך זה עוסק בשפת תכנות. אם התכוונתם לנחש, ראו פייתון.

**פייתון** (באנגלית: **Python**) היא שפת תכנות דינמית מהנפוצות ביותר. פייתון תוכננה תוך שימת דגש על קריאות הקוד, וכוללת מבנים המיועדים לאפשר ביטוי של תוכניות מורכבות בדרך קצרה וברורה. אחד המאפיינים הבולטים בתחביר השפה הוא השימוש בהזחה להגדרת בלוקים של קוד (ללא שימוש בסוגריים או במילים שמורות לצורך כך, כמו ברוב השפות הנפוצות).

פייתון היא שפה מרובת-פרדיגמות, המאפשרת תכנות מונחה-עצמים, תכנות פרוצדורלי, ובמידה מסוימת גם תכנות פונקציונלי. לשפה ספרייה סטנדרטית גדולה וענפה, והיא תומכת באופן מובנה בהרחבה שלה אל שפות אחרות (בתלות במפרש: C, ++C, Java ו-C#).

לשפה שתי גרסאות ראשיות, פייתון 2 ופייתון 3. פייתון 2 איננה בפיתוח יותר (למעט תיקון באגים), והתמיכה בה צפויה להסתיים ב-2020<sup>[2]</sup>.

שם השפה "פייתון" נבחר כמחווה לקבוצה הקומית "מונטי פייתון"<sup>[3]</sup>.

### תוכן עניינים [הסתרה]

- 1 עיצוב ופיתוח
- 2 מאפייני השפה
  - 2.1 המימוש: מהדר ומפרש
  - 2.2 סגנונות תכנות נתמכים
  - 2.3 ניהול הזיכרון ויצירת אובייקטים
  - 2.4 המשמעות התחברית של ההזחה
  - 2.5 מאפיינים תחביריים נוספים
- 3 מערכת הטיפוסים
  - 3.1 טיפוסים מובנים בשפה
  - 3.2 אנוטציות ובדיקת-טיפוסים סטטית
- 4 מבני בקרה
  - 4.1

**פייתון - Python**



**פרדיגמות** מונחית-עצמים, פרוצדורלית, פונקציונלית

**שנה** 1991

**מתכנן** גואידו ואן רוסום (הגייה - קישור חיצוני)

**מפתח** קרן התוכנה של פייתון<sup>[1]</sup>

**גרסה** 3.8.0 ב-14 באוקטובר 2019

**אחרונה** 2.7.17 ב-19 באוקטובר 2019

**טיפוסיות** דינמית (טיפוסיות ברזוז), חזקה, מובלעת

**מימושים** מפרשים: CPython, IronPython, Jython, Numba, PyPy, MicroPython

**ניבים** Stackless, RPython

**הושפעה** C, Scheme, Perl, ALGOL 60, ABC

**על ידי** Icon, LISP, Haskell, Java

**השפיעה** Groovy, Falcon, D, Cobra, Boo, C#, JavaScript, Ruby

**על**

**רישיון** Python Software Foundation License

**סיומת** .py, .pyw, .pyc, .pyo, .pyd

www.python.org

# 1. מבוא

drive.google.com/drive/u/0/my-drive

האחסון שלי

חדש

גישה מהירה

id	firstName	lastName	age	sex	relationship	gender	income
1	Bucky	Roberts	27	0.9182	single	male	23545.35
2	Lisa	Gallagher	29	1.7231	single	female	54532.79
3	Emma	Williams	43	0.7132	not single	female	39237.66
4	Tony	Manners	54	3.6266	not single	male	373698.80
5	Mike	Smith	12	0.0798	single	male	1650.63
6	Sally	Raphael	84	5.9521	not single	female	420273.13
7	Julie	Whitson	23	4.4270	single	male	158702.55
8	Nu	Wilson	30	1.1190	single	male	52098.79
9	Antonella	Moore	40	3.7034	single	female	281871.47
10	Tamara	Taylor	38	1.4125	not single	female	630038.36
11	Hilbert	Anderson	30	3.4985	not single	male	148661.39
12	Clara	Thomson	62	3.6884	single	male	313433.93

brUsers

פתחת את המסמך בחודש האחרון

polanitzerpython1.ipynb

3+4

4-3

4\*3

12/12

Copy of polanitzerpython1.ipynb

ערכת את המסמך בחודש האחרון

polanitzerpython1.ipynb

ערכת את המסמך בחודש האחרון

שם

תיקיות

אחסון

נוצלו GB 15 מתוך GB 10.3

קבציית שטח אחסון

לדף ההורדה של Backup and Sync ל-Windows

קבצים

TechSmith

Colab Notebooks

# 1. מבוא

The screenshot shows a Google Drive interface in Hebrew. At the top, the address bar displays the URL `drive.google.com/drive/u/0/my-drive`. Below the address bar, there are navigation icons and a search bar. The main content area shows a grid of files. One file, `polanitzerpython1.ipynb`, is highlighted. A context menu is open over this file, listing various Google services: Google Forms, Google Drawings, Google Sites, Google Colaboratory (circled in red), and Google Jamboard. Another context menu is open over the top right of the Drive interface, listing options like 'תיקיה' (Folder), 'העלאת קבצים' (Upload files), 'העלאת תיקיה' (Upload folder), 'Google Docs', 'Google Sheets', 'Google Slides', and 'עוד' (More), which is also circled in red. A notification at the bottom right indicates a backup of Windows 10.3 to 15 GB.

ID	firstName	lastName	age	sex	relationship	gender	income
1	Bucky	Roberts	27	0.9162	single	male	25365.35
2	Lin	Gallagher	29	1.7231	single	female	54232.79
3	Erma	Williams	43	0.7132	not single	female	26237.66
4	Tony	Motters	54	3.6266	not single	male	37356.80
5	Mike	Smith	12	0.0786	single	male	1650.63
6	Sally	Thompson	66	5.9021	not single	female	43223.13
7	John	Wilson	23	4.4075	single	male	19792.55
8	No	Wilson	30	1.1190	single	male	52596.79
9	Alexander	Morse	49	3.7034	single	female	28197.47
10	Tamara	Taylor	38	1.4125	not single	female	69039.35
11	Hilbert	Anderson	30	3.4860	not single	male	148991.39
12	Chen	Thomas	52	3.5884	single	male	311493.09

# 1. מבוא

co Untitled0.ipynb ☆  
File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text

Connect Editing ^

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# 1. מבוא



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text

Connect Editing ^



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# 1. מבוא



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing ^

```
!emge1,p,e,g'45[3]
```





# 1. מבוא

The screenshot shows a Jupyter Notebook interface for a file named 'Polanitzer1.ipynb'. The 'Runtime' menu is open, displaying various execution options. The 'Run selection' option and its keyboard shortcut 'Ctrl+Shift+Enter' are circled in red. The code cell contains the text `l,emge1,p,e,g'45[3]`. The interface includes a top navigation bar with 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help' menus. On the right, there are icons for 'Comment', 'Share', and 'Settings', along with a user profile picture. A status bar at the bottom right shows 'RAM' and 'Disk' usage indicators and an 'Editing' mode indicator.

# 1. מבוא

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitizer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right side, there are icons for "Comment", "Share", and "Settings", along with a user profile picture. Below the menu bar, there are controls for RAM and Disk usage, and a status indicator for "Editing". The main area of the notebook shows a code cell with the following content:

```
lmgel,p,e,g'45[3]'
```

The code is underlined in red, indicating an error. Below the code, the error message is displayed:

```
File "<ipython-input-5-289f5e18a0a7>", line 1  
lmgel,p,e,g'45[3]'  
SyntaxError: invalid syntax
```

The error message "SyntaxError: invalid syntax" is circled in red. Below the error message, there is a button that says "SEARCH STACK OVERFLOW".

# 1. מבוא

```
length, p, e, g, '45[3]'
```

File "<ipython-input-6-289f5e18a0a7>", line 1

```
length, p, e, g, '45[3]'
```

Clear output

^

Invalid syntax

executed by Roi Polanitzer

2:47 AM (0 minutes ago)

executed in 0.64s

LOW

[ ]

# 1. מבוא



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help Saving...

Comment Share Settings Profile

+ Code + Text

RAM  Disk  Editing ^

▶ `2+2`

↳ 4

[ ]



## 2. Math – פעולות מתמטיות

# Math .2 – פעולות מתמטיות

co Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[1] 3 + 4
```

```
7
```

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# Math .2 – פעולות מתמטיות

Polanitzer1.ipynb ☆  
File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

[1] 3 + 4

7

[2] 4 - 3

1

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# Math .2 – פעולות מתמטיות

The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status bar indicates "All changes saved".
- Right Panel:** Includes "Comment", "Share", a user profile icon, "RAM" and "Disk" usage indicators, and an "Editing" mode selector.
- Code Cells:**
  - Cell 1: `[1] 3 + 4` followed by a copy icon and the output `7`.
  - Cell 2: `[2] 4 - 3` followed by a copy icon and the output `1`.
  - Cell 3: `[3] 4 * 3` followed by a copy icon and the output `12`.
- Bottom Panel:** A toolbar with navigation and editing icons (up, down, link, comment, settings, trash, and a menu) and a play button.



# Math .2 – פעולות מתמטיות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

[1]  $3 + 4$

↳ 7

[2]  $4 - 3$

↳ 1

[3]  $4 * 3$

↳ 12

[4]  $12 / 3$

↳ 4.0



# 2. Math – פעולות מתמטיות

co Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

[1]  $3 + 4$   
7

[2]  $4 - 3$   
1

[3]  $4 * 3$   
12

[4]  $12 / 3$   
4.0

[5]  $5 * 5 * 5$   
125

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# Math .2 – פעולות מתמטיות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM   
Disk

Editing



[3]  $4 * 3$

↳ 12

[4]  $12 / 3$

↳ 4.0

[5]  $5 * 5 * 5$

↳ 125

[7]  $5**3$

↳ 125

[8]  $18 \% 4$

↳ 2

# Math .2 – פעולות מתמטיות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing



[5] `5 * 5 * 5`

↳ 125

[7] `5**3`

↳ 125

[8] `18 % 4`

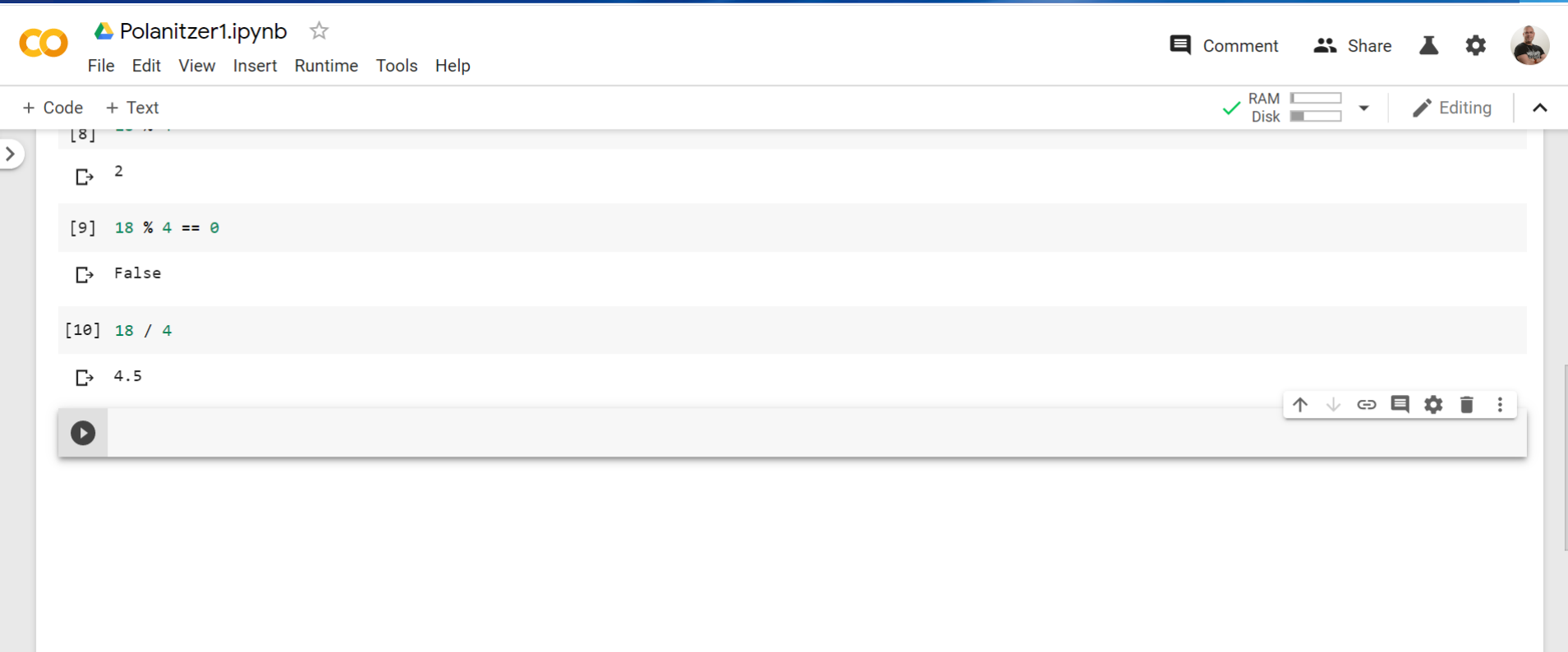
↳ 2

[9] `18 % 4 == 0`

↳ False



# 2. Math – פעולות מתמטיות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Right Panel:** "Comment", "Share", a user profile icon, "RAM" and "Disk" usage indicators, and an "Editing" mode selector.
- Code Cells:**
  - Cell [8]: `2` (output: `2`)
  - Cell [9]: `18 % 4 == 0` (output: `False`)
  - Cell [10]: `18 / 4` (output: `4.5`)
- Bottom Panel:** A toolbar with icons for up, down, link, comment, settings, trash, and a play button.

# 2. Math – פעולות מתמטיות

The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Right Panel:** "Comment", "Share", "Settings", and a user profile icon.
- Toolbar:** "+ Code", "+ Text", "RAM" (with a green checkmark and a slider), "Disk" (with a slider), "Editing" (with a pencil icon), and an upward arrow.
- Code Cells:**
  - Cell 1: `2` (output: `2`)
  - Cell 2: `18 % 4 == 0` (output: `False`)
  - Cell 3: `18 / 4` (output: `4.5`)
  - Cell 4: `18 // 4` (output: `4`)
- Bottom Panel:** A play button icon and a vertical line cursor.
- Bottom Right:** A small toolbar with icons for up, down, refresh, comment, settings, and delete.

# 2. Math – פעולות מתמטיות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM  Disk  Editing

```
[ ]  
[ ] 2  
[9] 18 % 4 == 0  
[ ] False  
[10] 18 / 4  
[ ] 4.5  
[11] 18 // 4  
[ ] 4  
[12] four = 4
```

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▶

# Math .2 – פעולות מתמטיות

Polanitzer1.ipynb ☆  
File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[ ]  
[ ] 2  
[9] 18 % 4 == 0  
[ ] False  
[10] 18 / 4  
[ ] 4.5  
[11] 18 // 4  
[ ] 4  
[12] four = 4
```





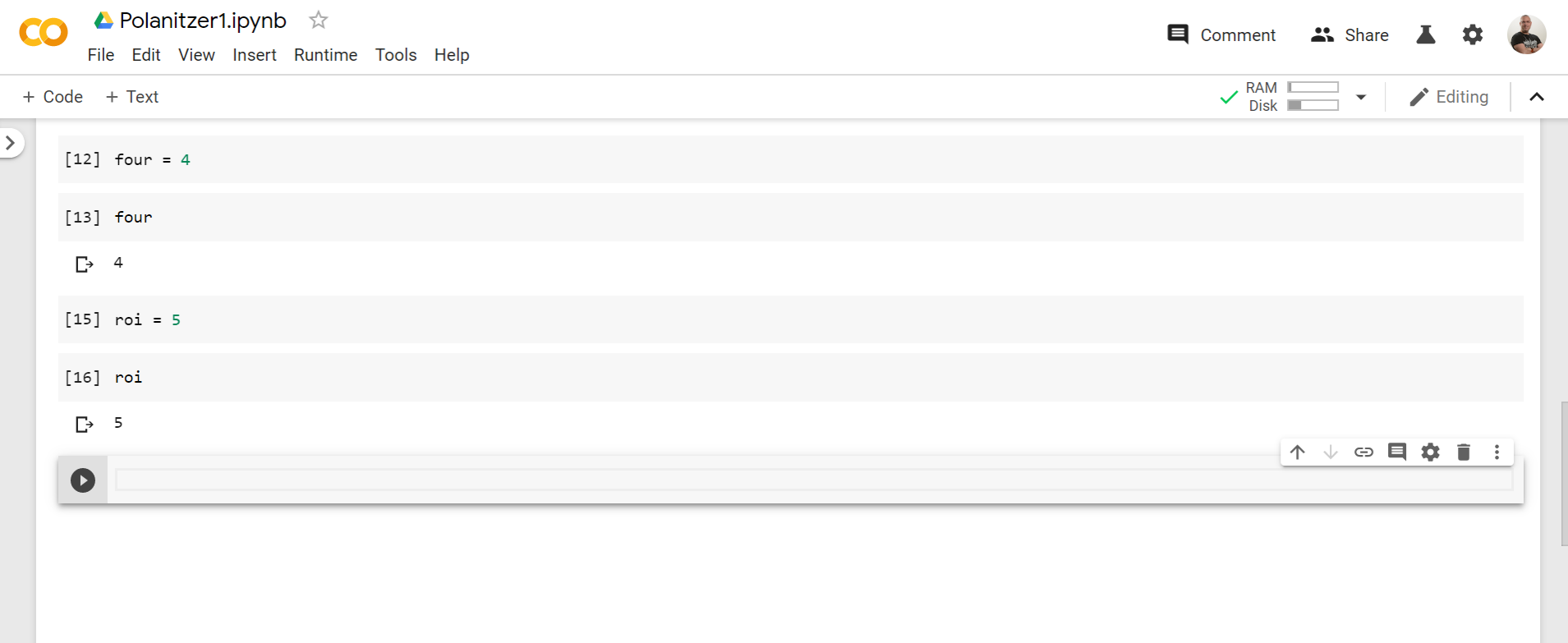
# Math .2 – פעולות מתמטיות

The screenshot shows a Jupyter Notebook titled "Polanitzer1.ipynb". The interface includes a top navigation bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help" menus. On the right, there are buttons for "Comment", "Share", and a user profile icon. Below the navigation bar, there are tabs for "+ Code" and "+ Text". The main area contains several code cells:

- Cell [10]: `18 / 4` resulting in `4.5`
- Cell [11]: `18 // 4` resulting in `4`
- Cell [12]: `four = 4`
- Cell [13]: `four` resulting in `4`

At the bottom right of the code area, there is a toolbar with icons for up, down, link, comment, settings, and delete. A play button is visible at the bottom left of the code area.

# 2. Math – פעולות מתמטיות



The screenshot displays a Jupyter Notebook interface with the following elements:

- Top Bar:** Includes the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask, a gear, and a user profile.
- Menu:** A horizontal menu with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Toolbar:** Contains "+ Code", "+ Text", a RAM/Disk usage indicator (showing a green checkmark and a bar), and an "Editing" mode indicator.
- Code Cells:**
  - Cell [12]: `four = 4`
  - Cell [13]: `four`, with output `4`.
  - Cell [15]: `roi = 5`
  - Cell [16]: `roi`, with output `5`.
- Bottom Bar:** Features a play button and a set of control icons (up, down, link, comment, gear, trash, and a vertical ellipsis).

# Math .2 – פעולות מתמטיות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

[12] four = 4

[13] four

4

[15] roi = 5

[16] roi

5

[17] roi + four

9



# Math .2 – פעולות מתמטיות

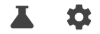


Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM   
Disk

Editing

[12] four = 4

[13] four

↳ 4

[15] roi = 5

[16] roi

↳ 5

[17] roi + four

↳ 9

[18] roi \*\* four

↳ 625





## 3. Strings - מחרוזות

# .3 Strings - מחרזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

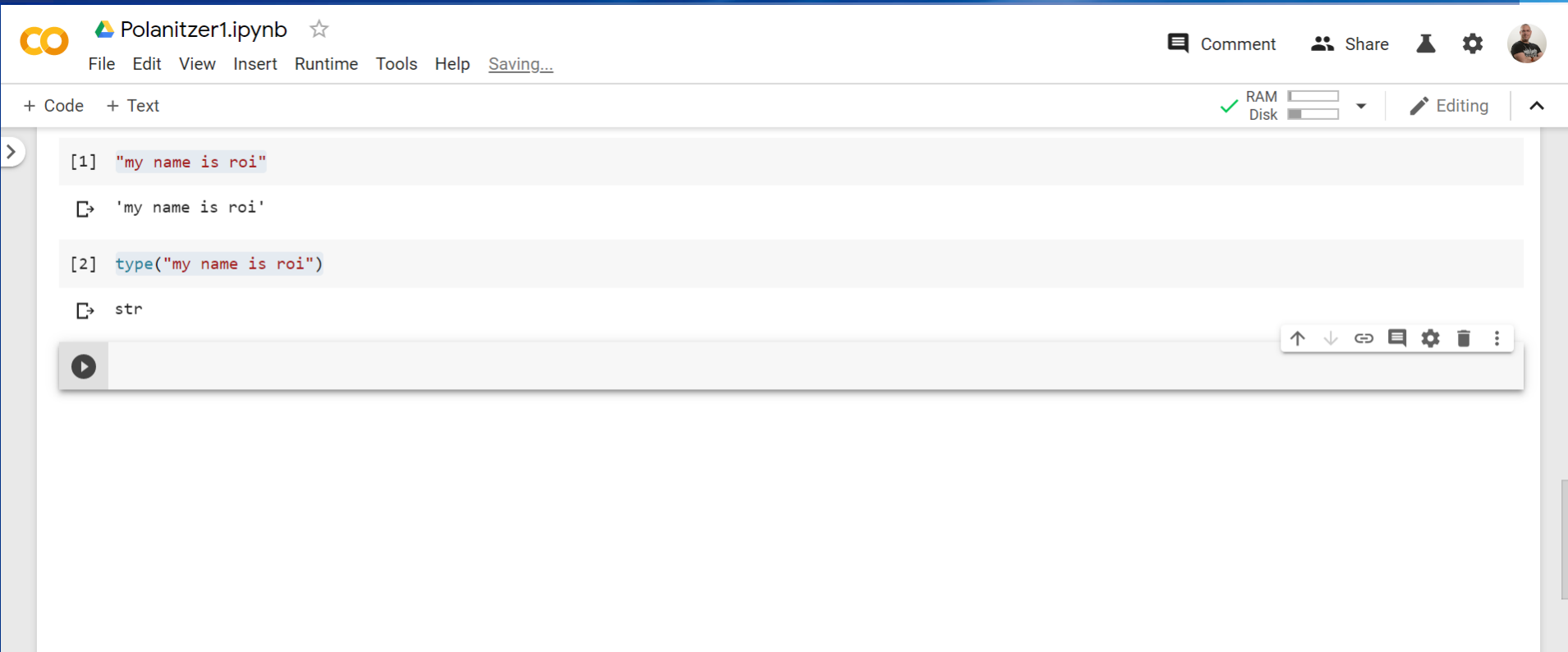
+ Code + Text

RAM Disk Editing

```
[ ] 5
[ ] roi + four
[ ] 9
[ ] roi ** four
[ ] 625
[1] "my name is roi"
[ ] 'my name is roi'
```

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# 3. Strings - מחרזות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".
- Right Panel:** "Comment", "Share", "RAM" (with a green checkmark and a progress bar), "Disk" (with a progress bar), "Editing" (with a pencil icon), and a user profile icon.
- Code Cells:**
  - Cell 1: `[1] "my name is roi"` with output `'my name is roi'`.
  - Cell 2: `[2] type("my name is roi")` with output `str`.
- Bottom Bar:** A play button icon and a toolbar with icons for up, down, link, comment, settings, and trash.

# מחרוזות - Strings .3



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

[1] `"my name is roi"`

↳ `'my name is roi'`

[2] `type("my name is roi")`

↳ `str`

[3] `'my name is roi'`

↳ `'my name is roi'`

[4] `type('my name is roi')`

↳ `str`





# מחרוזות - Strings .3

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[4] type('my name is roi')
```

```
str
```

```
'I don't like pizza'
```

```
File "<ipython-input-6-466367631e13>", line 1
  'I don't like pizza'
    ^
SyntaxError: invalid syntax
```

SEARCH STACK OVERFLOW

```
[ ]
```

# מחרוזות - Strings .3

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

+ Code + Text

RAM  Disk  Editing

```
[4] type('my name is roi')  
str
```

```
[6] 'I don't like pizza'  
File "<ipython-input-6-466367631e13>", line 1  
    'I don't like pizza'  
      ^  
SyntaxError: invalid syntax
```

SEARCH STACK OVERFLOW

```
[7] "I don't like pizza"  
"I don't like pizza"
```

# מחרוזות - Strings .3

CO Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share

+ Code + Text

RAM Disk Editing

```
[7] "I don't like pizza"
↳ "I don't like pizza"

[8] 'I don\'t like pizza'
↳ "I don't like pizza"
```

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# .3 Strings - מחרזות

CO Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

+ Code + Text

RAM  Disk  Editing

```
[7] "I don't like pizza"
↳ "I don't like pizza"

[8] 'I don\'t like pizza'
↳ "I don't like pizza"

[9] my_name = "Roi"

[10] like = "Pizza"
```

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# מחרוזות - Strings .3



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM   
Disk

Editing



```
[7] "I don't like pizza"
```

```
↳ "I don't like pizza"
```

```
[8] 'I don\'t like pizza'
```

```
↳ "I don't like pizza"
```

```
[9] my_name = "Roi"
```

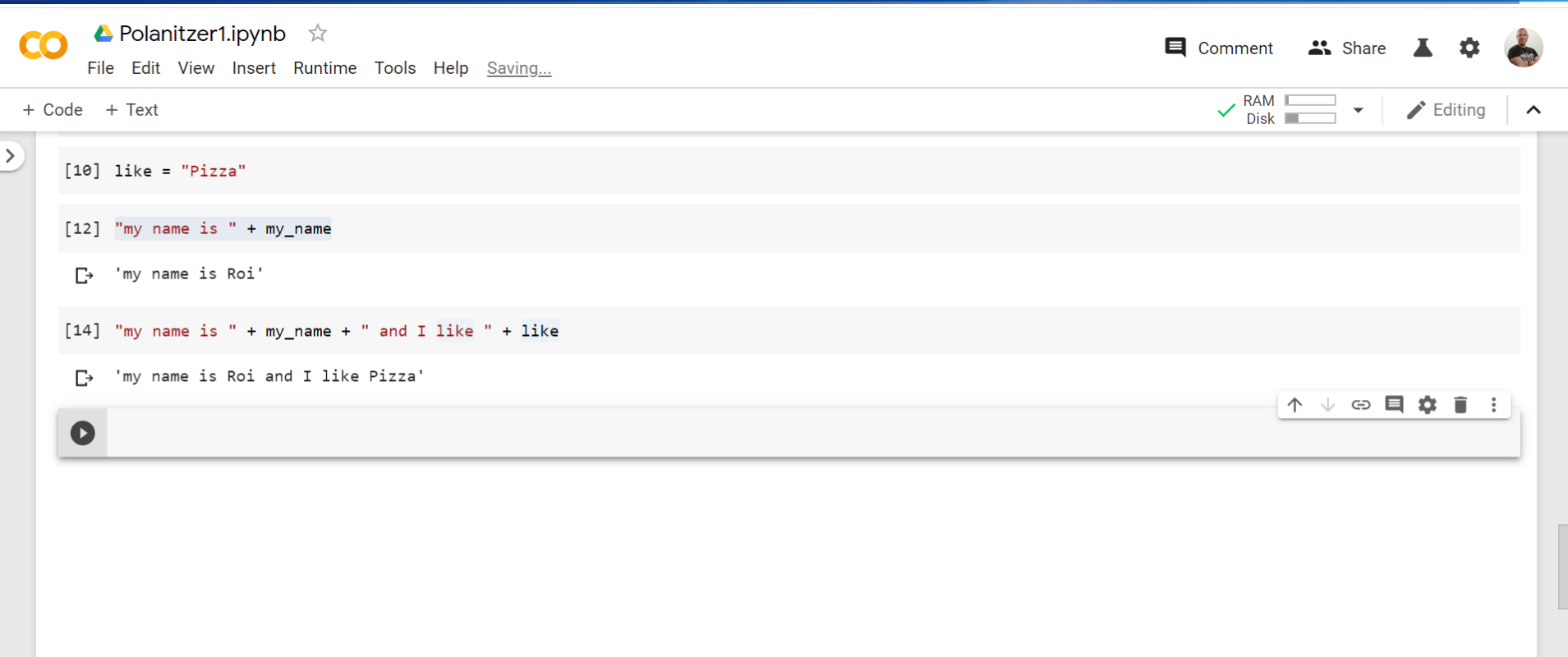
```
[10] like = "Pizza"
```

```
[12] "my name is " + my_name
```

```
↳ 'my name is Roi'
```



# מחרוזות - Strings .3



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for Comment, Share, a flask, a gear, and a user profile.
- Menu:** A horizontal menu with options: File, Edit, View, Insert, Runtime, Tools, Help, and Saving...
- Toolbar:** Includes "+ Code" and "+ Text" buttons on the left. On the right, there are indicators for RAM and Disk usage, an "Editing" mode button, and an upward arrow.
- Code Cells:**
  - Cell [10]: `like = "Pizza"`
  - Cell [12]: `"my name is " + my_name`  
Output: `'my name is Roi'`
  - Cell [14]: `"my name is " + my_name + " and I like " + like`  
Output: `'my name is Roi and I like Pizza'`
- Execution Bar:** A horizontal bar at the bottom of the code area with a play button on the left and navigation icons (up, down, refresh, comment, settings, trash, menu) on the right.

# מחרוזות - Strings .3



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".
- Toolbar:** Includes "Comment", "Share", a flask icon, a gear icon, and a user profile icon.
- Code Cells:**
  - Cell [14]:

```
"my name is " + my_name + " and I like " + like
```

```
'my name is Roi and I like Pizza'
```
  - Cell [15]:

```
words = "my name is " + my_name + " and I like " + like
```
  - Cell [17]:

```
words
```

```
'my name is Roi and I like Pizza'
```
- Output Area:** A large empty box with a play button icon on the left and a toolbar on the right containing icons for up, down, refresh, comment, settings, delete, and a menu.

# 3. Strings - מחרזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[17] words
↳ 'my name is Roi and I like Pizza'
```

```
[18] like = 5
```

```
[19] words = "my name is " + my_name + " and I like " + like
↳ -----
TypeError                                 Traceback (most recent call last)
<ipython-input-19-96fb1e698519> in <module>()
----> 1 words = "my name is " + my_name + " and I like " + like

TypeError: must be str, not int
```

SEARCH STACK OVERFLOW

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# 3. Strings - מחרזות

The screenshot shows a Jupyter Notebook interface with the following elements:

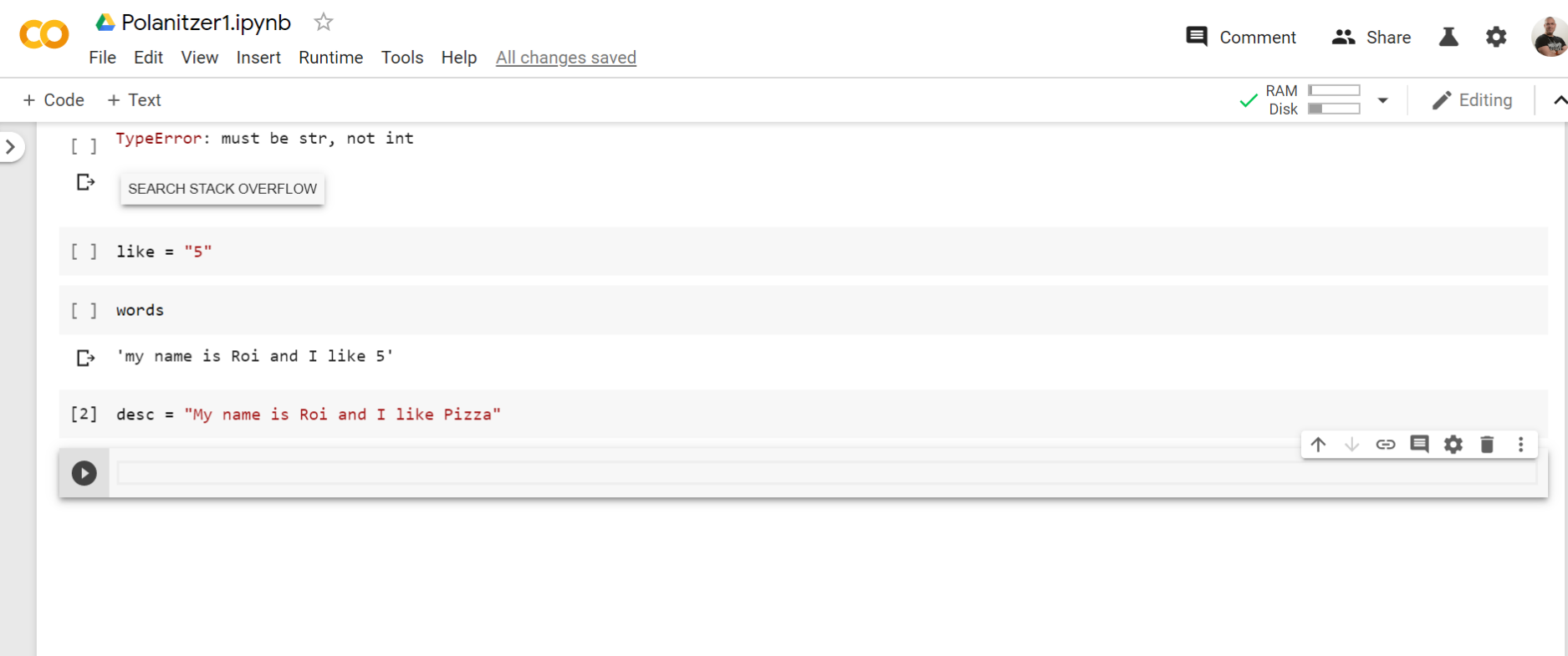
- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status message "All changes saved" is visible.
- Right Panel:** Includes "Comment", "Share", a flask icon, a gear icon, and a user profile picture.
- Toolbar:** Shows "+ Code", "+ Text", "RAM Disk" status, and "Editing" mode.
- Code Cell [19]:** Contains the text `TypeError: must be str, not int`. Below it is a "SEARCH STACK OVERFLOW" button.
- Code Cell [24]:** Contains the code `like = "5"`.
- Code Cell [25]:** Contains the code `words`.
- Code Cell [26]:** Contains the code `'my name is Roi and I like 5'`.
- Execution Bar:** At the bottom of the code cells, there is a play button and a progress indicator.



# 4. Strings Slicing - חיתוך

## מחרוזות

# 4. Strings Slicing - חיתוך מחרוזות



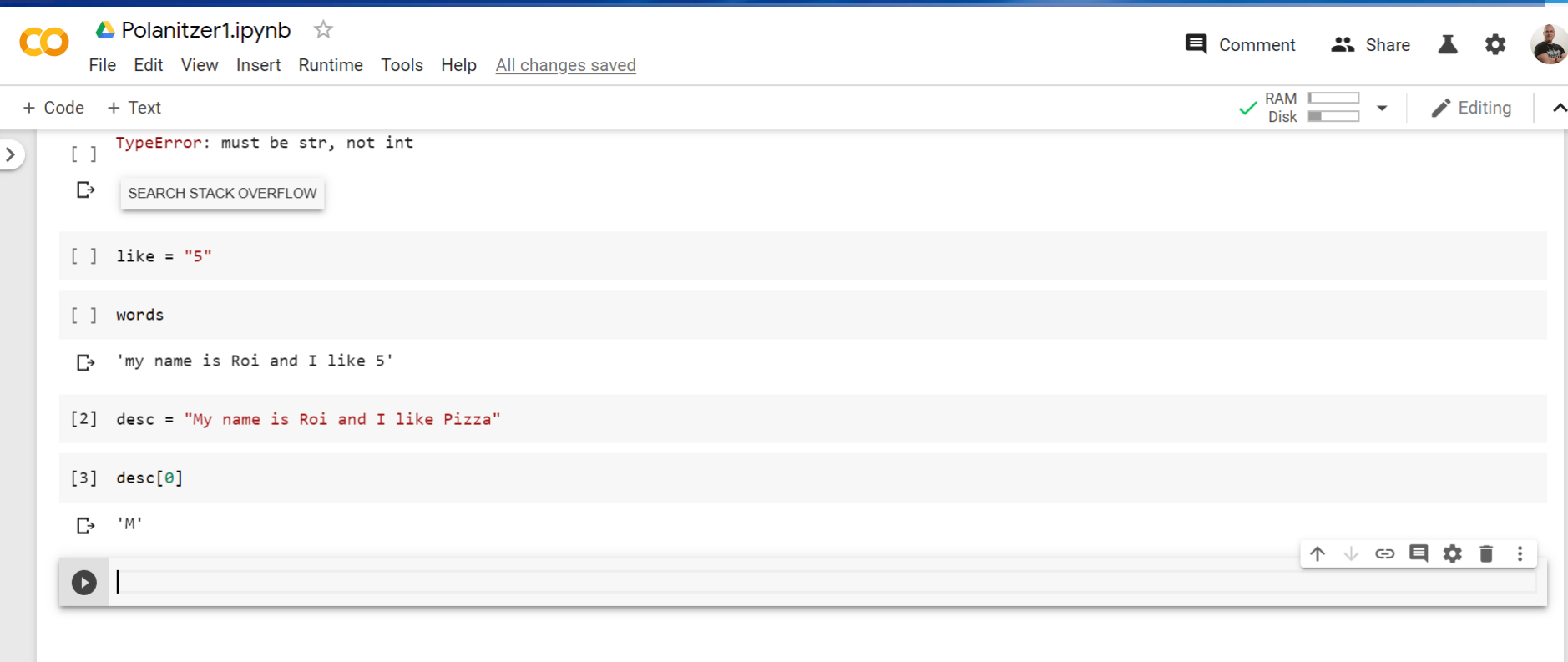
The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb" and has a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a link to "All changes saved". On the right, there are icons for "Comment", "Share", a flask, a gear, and a user profile. Below the menu bar, there are controls for "+ Code" and "+ Text", and a status bar showing "RAM" and "Disk" usage, a "Editing" mode indicator, and a scroll bar.

The code cell contains the following Python code:

```
[ ] TypeError: must be str, not int  
[ ] like = "5"  
[ ] words  
[ ] 'my name is Roi and I like 5'  
[2] desc = "My name is Roi and I like Pizza"
```

Below the code cell, there is a search bar with the text "SEARCH STACK OVERFLOW" and a play button icon.

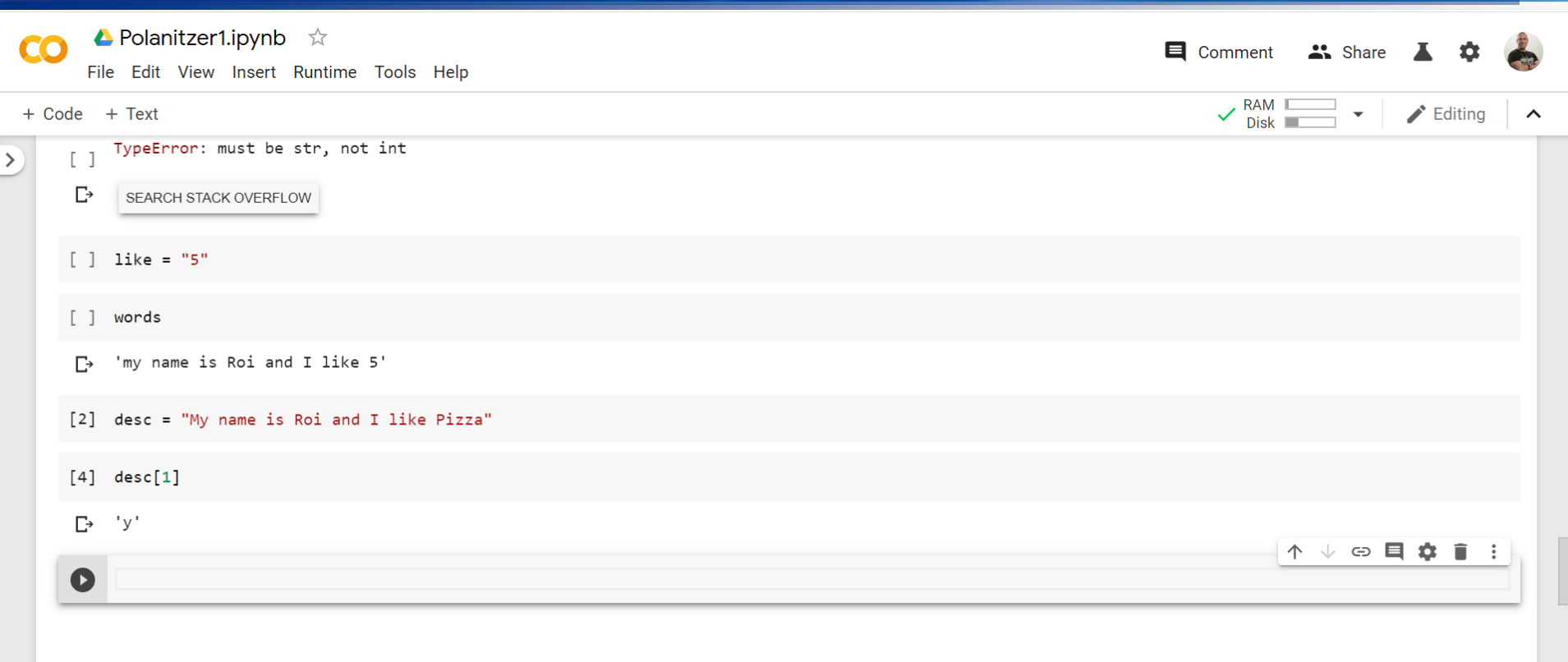
# 4. Strings Slicing - חיתוך מחרוזות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status bar indicates "All changes saved".
- Right Panel:** Includes "Comment", "Share", a user profile icon, and system indicators for "RAM" and "Disk" usage, along with an "Editing" mode indicator.
- Code Cells:**
  - Cell 0: Contains a red error message: `TypeError: must be str, not int`. Below it is a "SEARCH STACK OVERFLOW" button.
  - Cell 1: `like = "5"`
  - Cell 2: `words`
  - Cell 3: `'my name is Roi and I like 5'`
  - Cell 4: `desc = "My name is Roi and I like Pizza"`
  - Cell 5: `desc[0]`
  - Cell 6: `'M'`
- Bottom Panel:** A play button icon and a search bar.

# 4. Strings Slicing - חיתוך מחרוזות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Includes the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile picture.
- Menu:** A horizontal menu with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Code Cell:** Contains the following Python code:

```
[ ] TypeError: must be str, not int  
[ ] like = "5"  
[ ] words  
[ ] 'my name is Roi and I like 5'  
[2] desc = "My name is Roi and I like Pizza"  
[4] desc[1]  
[ ] 'y'
```
- Output Area:** Shows a search bar with the text "SEARCH STACK OVERFLOW". Below it, there are several empty rectangular boxes representing the output of the code cells.
- Bottom Bar:** Features a play button on the left and a set of control icons (up, down, link, comment, gear, trash, and a vertical ellipsis) on the right.
- RAM/Disk:** A small indicator in the top right shows "RAM" and "Disk" usage with progress bars.
- Editing:** A button labeled "Editing" is visible in the top right.

# 4. Strings Slicing - חיתוך מחרוזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[ ] TypeError: must be str, not int
```

SEARCH STACK OVERFLOW

```
[ ] like = "5"
```

```
[ ] words
```

```
[ ] 'my name is Roi and I like 5'
```

```
[2] desc = "My name is Roi and I like Pizza"
```

```
[5] desc[3]
```

```
[ ] 'n'
```

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# 4. Strings Slicing - חיתוך מחרוזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share

+ Code + Text

RAM Disk Editing

```
[ ] TypeError: must be str, not int
```

SEARCH STACK OVERFLOW

```
[ ] like = "5"
```

```
[ ] words
```

```
[ ] 'my name is Roi and I like 5'
```

```
[2] desc = "My name is Roi and I like Pizza"
```

```
[6] desc[-1]
```

```
[ ] 'a'
```

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# 4. Strings Slicing - חיתוך מחרוזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[ ] TypeError: must be str, not int
```

SEARCH STACK OVERFLOW

```
[ ] like = "5"
```

```
[ ] words
```

```
[ ] 'my name is Roi and I like 5'
```

```
[2] desc = "My name is Roi and I like Pizza"
```

```
[7] desc[-2]
```

```
[ ] 'z'
```

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# 4. Strings Slicing - חיתוך מחרוזות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

RAM   
Disk

Editing

[ ] `TypeError: must be str, not int`

[SEARCH STACK OVERFLOW](#)

[ ] `like = "5"`

[ ] `words`

`'my name is Roi and I like 5'`

[2] `desc = "My name is Roi and I like Pizza"`

[8] `desc[2:7]`

`' name'`



# 4. Strings Slicing - חיתוך מחרוזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share

+ Code + Text

RAM Disk Editing

```
[ ] TypeError: must be str, not int
```

SEARCH STACK OVERFLOW

```
[ ] like = "5"
```

```
[ ] words
```

```
[ ] 'my name is Roi and I like 5'
```

```
[2] desc = "My name is Roi and I like Pizza"
```

```
[9] desc[4:-3]
```

```
[ ] 'ame is Roi and I like Pi'
```

IAVFA

# 4. Strings Slicing - חיתוך מחרוזות

CO Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

+ Code + Text

RAM  Disk  Editing

```
> 'a'  
[16] desc[-2]  
'a'  
'z'  
[17] desc[2:7]  
' name'  
[18] desc[4:-3]  
'ame is Roi and I like Pi'  
[19] desc[:6]  
'My nam'
```

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# 4. Strings Slicing - חיתוך מחרוזות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[17] desc[4:7]
↳ ' name'
```

```
[18] desc[4:-3]
↳ 'ame is Roi and I like Pi'
```

```
[19] desc[:6]
↳ 'My nam'
```

```
[20] desc[:]
↳ 'My name is Roi and I like Pizza'
```

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# .5 Lists – רשימות

# רשימות – Lists .5

The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".
- Right Panel:** "Comment", "Share", "Settings", and a user profile icon. Below these are "RAM" and "Disk" usage indicators, and an "Editing" mode selector.
- Code Cell:** Contains the following code:

```
'My name is Roi and I like Pizza'  
  
[21] ages = []  
  
[23] type(ages)  
  
list
```
- Execution:** A play button icon is visible on the left side of the code cell, indicating it has been executed.
- Output:** The output area is currently empty.

# רשימות – Lists .5

The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status message "All changes saved" is visible.
- Right Side:** "Comment", "Share", and "Settings" icons, along with a user profile picture.
- Code Cells:**
  - Cell 1: `'My name is Roi and I like Pizza'`
  - Cell 2: `[24] ages = [25,34,55,66,88]`
  - Cell 3: `[27] ages`
  - Cell 4: `[25, 34, 55, 66, 88]`
- Output Area:** A large empty box with a play button icon on the left and a toolbar on the right containing icons for scroll, copy, comment, settings, and delete.
- Bottom Bar:** "+ Code" and "+ Text" buttons.

# רשימות – Lists .5

+ Code + Text

RAM Disk Editing ^

```
'My name is Roi and I like Pizza'
```

```
[24] ages = [25,34,55,66,88]
```

```
ages[0]
```

```
25
```



# רשימות – Lists .5

+ Code + Text

RAM Disk Editing

```
'My name is Roi and I like Pizza'
```

```
[24] ages = [25,34,55,66,88]
```

```
[29] ages[2]
```

```
55
```

Navigation icons: up, down, link, comment, settings, trash, menu

# רשימות – Lists .5

+ Code + Text

RAM Disk Editing

```
'My name is Roi and I like Pizza'
```

```
[24] ages = [25,34,55,66,88]
```

```
[30] ages[2:4]
```

```
[55, 66]
```

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# רשימות – Lists .5

+ Code + Text

```
↳ my name is Roi and I like Pizza
```

```
[24] ages = [25,34,55,66,88]
```

```
[30] ages[2:4]
```

```
↳ [55, 66]
```

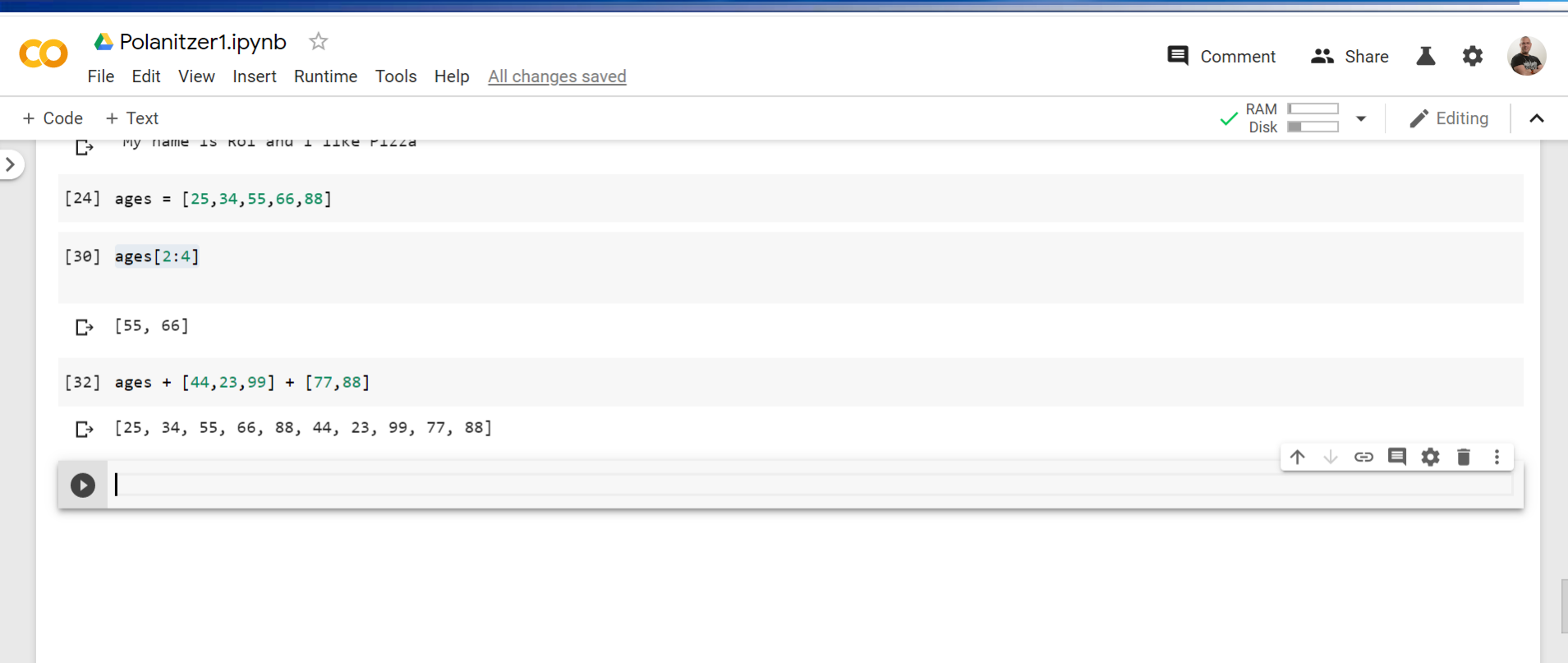
```
[31] ages + [44,23,99]
```

```
↳ [25, 34, 55, 66, 88, 44, 23, 99]
```

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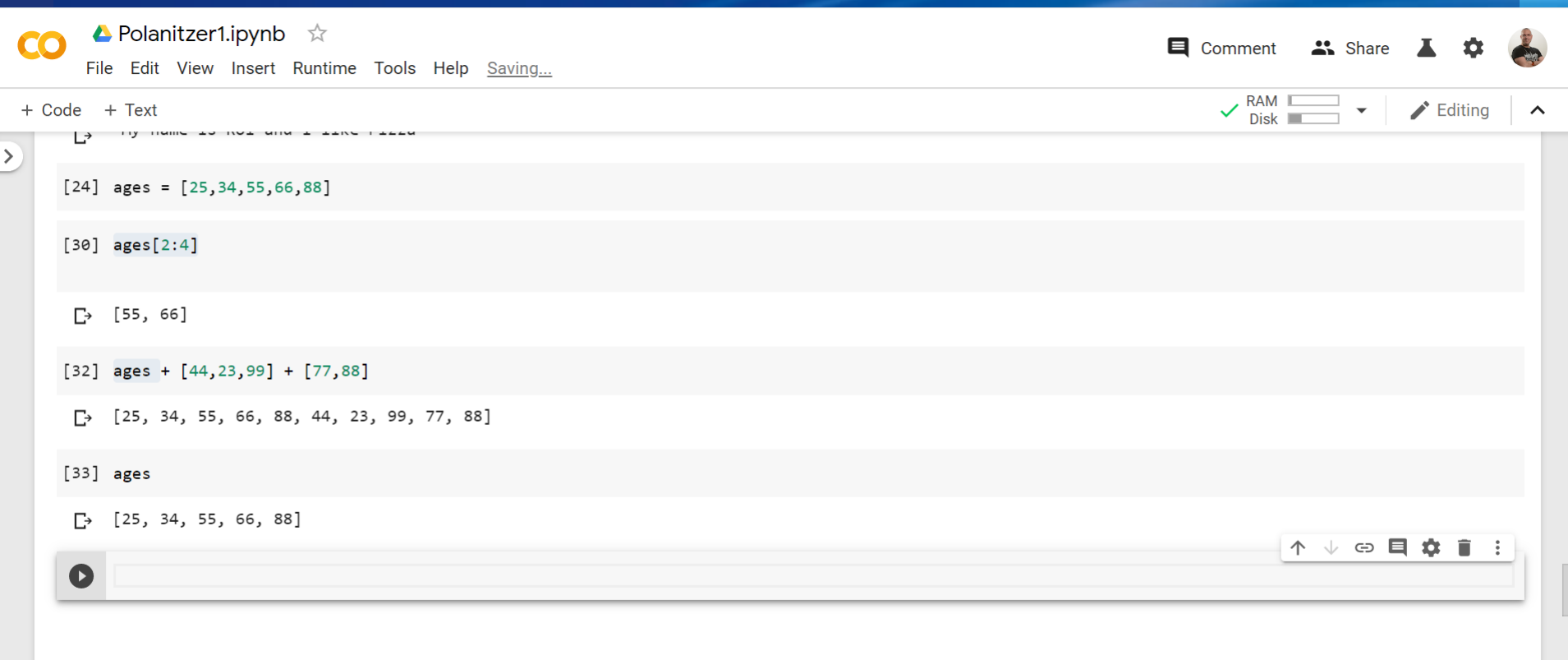
# .5 Lists – רשימות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Jupyter logo, the filename "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile picture.
- Menu Bar:** Includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status indicator "All changes saved" is visible.
- Code Editor:** Shows a sequence of code cells:
  - Cell 1: A comment "My name is Roi and I like Pizza".
  - Cell 2: `[24] ages = [25,34,55,66,88]`
  - Cell 3: `[30] ages[2:4]`
  - Cell 4: Output `[55, 66]`
  - Cell 5: `[32] ages + [44,23,99] + [77,88]`
  - Cell 6: Output `[25, 34, 55, 66, 88, 44, 23, 99, 77, 88]`
- Right Panel:** Shows "RAM" and "Disk" usage bars, a "Editing" mode indicator, and a vertical scroll bar.
- Bottom Panel:** A toolbar with icons for up, down, link, comment, settings, trash, and a menu.

# .5 Lists – רשימות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and navigation links: "File Edit View Insert Runtime Tools Help Saving...".
- Right Panel:** "Comment", "Share", "RAM" (with a progress bar), "Disk" (with a progress bar), "Editing" (with a pencil icon), and a user profile icon.
- Code Cells:**
  - Cell [24]: `ages = [25, 34, 55, 66, 88]`
  - Cell [30]: `ages[2:4]`
  - Cell [31]: `[55, 66]`
  - Cell [32]: `ages + [44, 23, 99] + [77, 88]`
  - Cell [33]: `ages`
- Output:** The outputs of the code cells are displayed below each cell:
  - Output of [30]: `[55, 66]`
  - Output of [32]: `[25, 34, 55, 66, 88, 44, 23, 99, 77, 88]`
  - Output of [33]: `[25, 34, 55, 66, 88]`
- Bottom Panel:** A toolbar with icons for up, down, link, comment, settings, trash, and a play button.

# רשימות – Lists .5



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

RAM   
Disk

Editing

```
my name is Roi and I like Pizza
```

```
[24] ages = [25,34,55,66,88]
```

```
[30] ages[2:4]
```

```
[55, 66]
```

```
[34] newages = ages + [44,23,99] + [77,88]
```

```
[35] newages
```

```
[25, 34, 55, 66, 88, 44, 23, 99, 77, 88]
```



# רשימות – Lists .5



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing ^

[55, 66]

```
[34] newages = ages + [44,23,99] + [77,88]
```

```
[37] ages.append(120)
```

```
[38] ages
```

[25, 34, 55, 66, 88, 120]

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6. If > Else – התניות



# 6. Else > If – התניות

co Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[55, 66]
```

```
[34] newages = ages + [44,23,99] + [77,88]
```

```
[37] ages.append(120)
```

```
[38] ages
```

```
[25, 34, 55, 66, 88, 120]
```

```
[39] my_friend = "bob"
```

```
[40] my_friend
```

```
'bob'
```

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▶ |

# 6. Else > If – התניות

The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Includes the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a settings gear, and a user profile picture.
- Menu:** "File Edit View Insert Runtime Tools Help".
- Toolbar:** "+ Code + Text", "RAM Disk" status with a green checkmark, and "Editing" mode.
- Code Cells:**
  - Cell 1: `[55, 66]`
  - Cell 2: `[34] newages = ages + [44,23,99] + [77,88]`
  - Cell 3: `[37] ages.append(120)`
  - Cell 4: `[38] ages`
  - Cell 5: `[25, 34, 55, 66, 88, 120]`
  - Cell 6: `[39] my_friend = "bob"`
  - Cell 7: `[41] if my_friend is "bob":  
 print("whatsup dude?")`
  - Cell 8: `whatsup dude?`
- Bottom Bar:** A play button icon and a toolbar with icons for up, down, link, comment, settings, trash, and a menu.

# 6. If > Else – התניות

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[38] ages
[ ] [25, 34, 55, 66, 88, 120]

[42] my_friend = "sami"

if my_friend is "bob":
    print("whatsup dude?")
elif my_friend is "sami":
    print("Hi sami!!!")

[ ] Hi sami!!!

[ ]
```

# 6. If > Else – התניות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the file name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask, a gear, and a user profile.
- Menu:** A horizontal menu with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Toolbar:** Includes "+ Code", "+ Text", a RAM/Disk usage indicator (showing green for RAM and grey for Disk), and an "Editing" mode indicator.
- Code Cell [38]:** Contains the variable assignment `ages` and its output, a list `[25, 34, 55, 66, 88, 120]`.
- Code Cell [46]:** Contains the variable assignment `my_friend = "ron"`.
- Code Cell [47]:** Contains an `if-elif-else` conditional statement:

```
[47] if my_friend is "bob":  
    print("whatsup dude?")  
elif my_friend is "sami":  
    print("Hi sami!!!")  
else:  
    print("I don't know you")
```
- Output Cell:** Shows the output of the conditional statement: `I don't know you`.
- Bottom Bar:** A toolbar with navigation icons (up, down, left, right), a play button, and a settings menu.

# 6. If > Else – התניות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[47] if my_friend is "bob":  
    print("whatsup dude?")  
    elif my_friend is "sami":  
        print("Hi sami!!!")  
    else:  
        print("I don't know you")
```

I don't know you

```
[48] my_number = 5
```

```
[50] if my_number is 5:  
    print("whatsup dude?")  
    else:  
        print("I don't know you")
```

whatsup dude?

Navigation icons

# 6. If > Else – התניות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

```
[47] if my_friend is "bob":  
    print("whatsup dude?")  
elif my_friend is "sami":  
    print("Hi sami!!!")  
else:  
    print("I don't know you")
```

I don't know you

```
[48] my_number = 5
```

```
[52] if my_number is 5:  
    print("whatsup dude?")
```

whatsup dude?





for loop – לולאה מסוג for .7

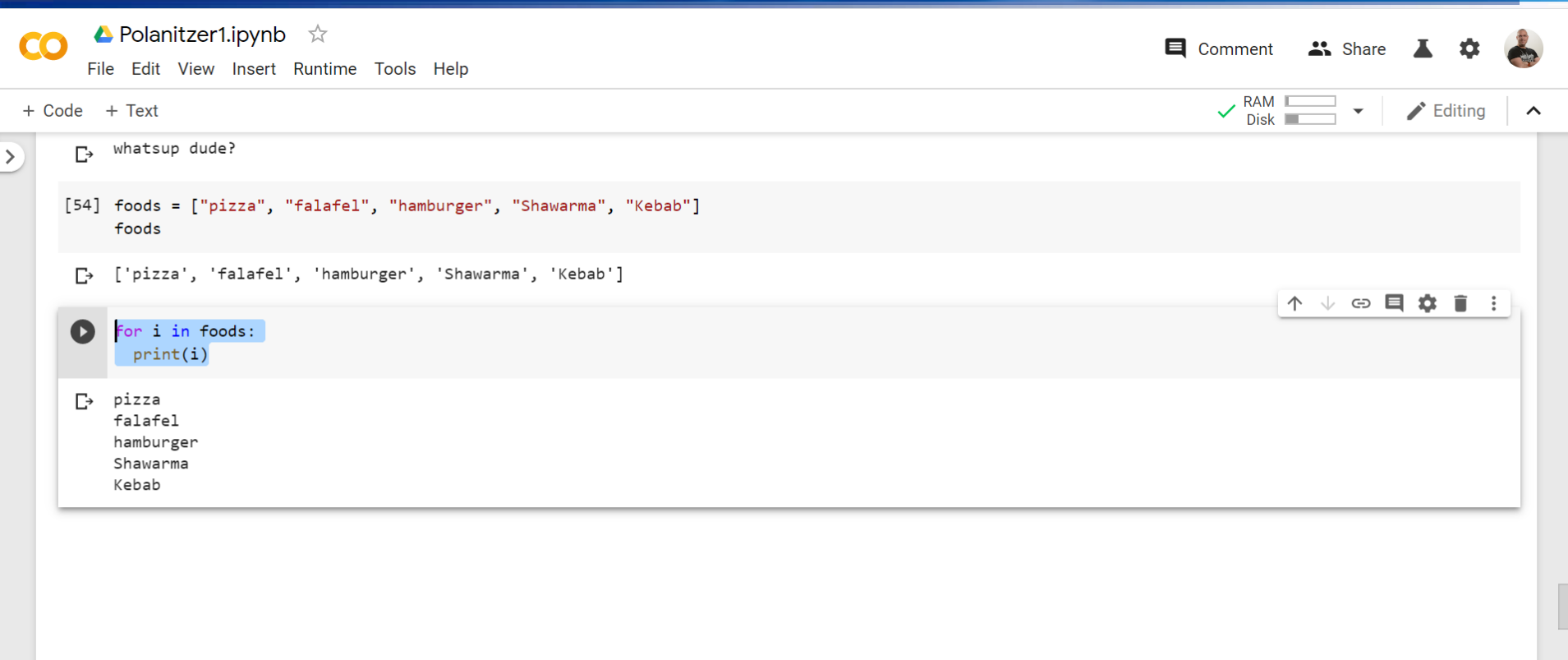
# for loop – לולאה מסוג for

The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for Comment, Share, a flask, a gear, and a user profile.
- Menu:** A horizontal menu with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Toolbar:** Includes "+ Code", "+ Text", a RAM/Disk usage indicator, and an "Editing" mode selector.
- Code Cell 1:** Contains the code `[52] if my_number is 5: print("whatsup dude?")`. The output is `whatsup dude?`.
- Code Cell 2:** Contains the code `[54] foods = ["pizza", "falafel", "hamburger", "Shawarma", "Kebab"] foods`. The output is `['pizza', 'falafel', 'hamburger', 'Shawarma', 'Kebab']`.
- Execution Bar:** A horizontal bar at the bottom of the code cells with a play button and a toolbar containing icons for up, down, refresh, comment, settings, and delete.



# for loop – לולאה מסוג for .7



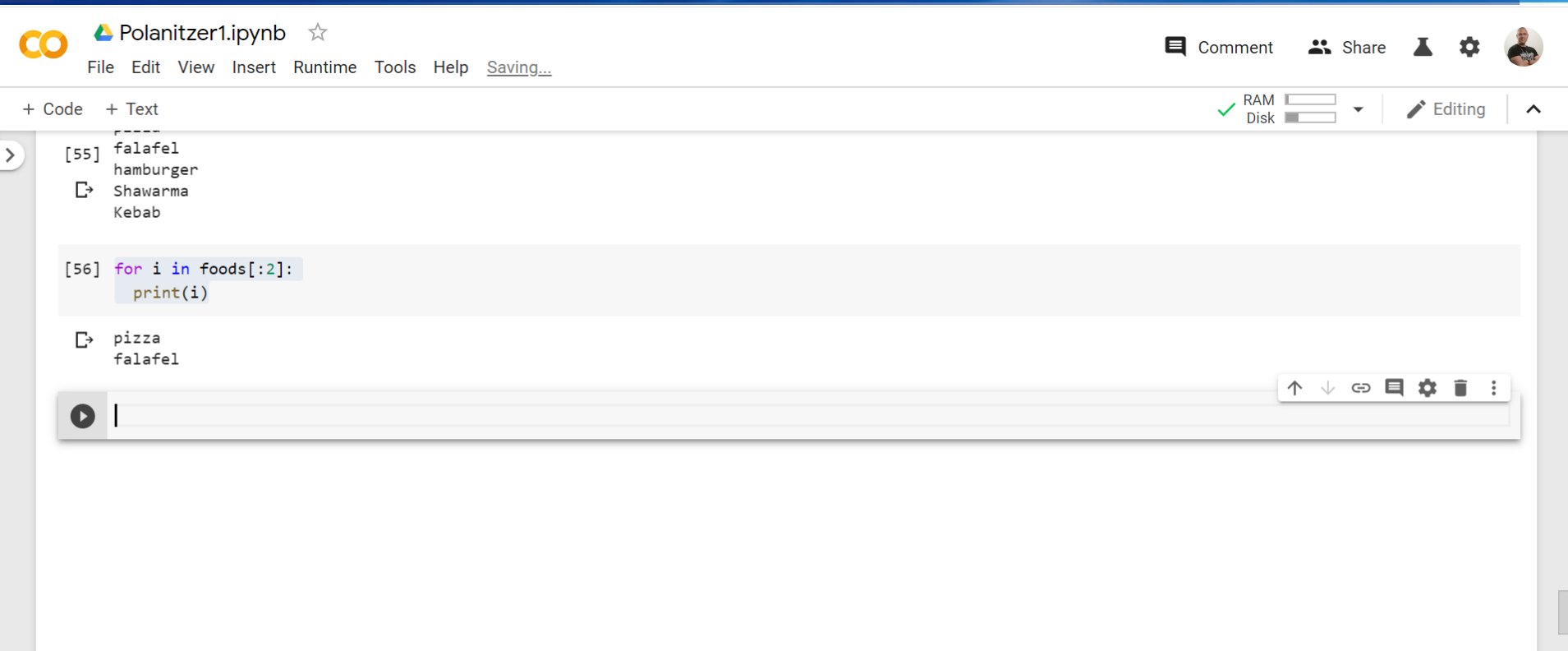
The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile icon.
- Menu Bar:** Includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Toolbar:** Shows "+ Code" and "+ Text" on the left. On the right, there are indicators for "RAM" and "Disk" usage, a pencil icon for "Editing", and an upward arrow icon.
- Code Cell:** Contains the following code:

```
whatsup dude?  
  
[54] foods = ["pizza", "falafel", "hamburger", "Shawarma", "Kebab"]  
      foods  
  
['pizza', 'falafel', 'hamburger', 'Shawarma', 'Kebab']  
  
for i in foods:  
    print(i)
```
- Output:** The code cell has been executed, resulting in the following output:

```
pizza  
falafel  
hamburger  
Shawarma  
Kebab
```

# for loop – לולאה מסוג for



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...". On the right side, there are icons for "Comment", "Share", a user profile, and a settings gear. Below the menu bar, there are tabs for "+ Code" and "+ Text". The main area displays two code cells. The first cell, labeled "[55]", contains a list of food items: "falafel", "hamburger", "Shawarma", and "Kebab". The second cell, labeled "[56]", contains a Python for loop: 

```
for i in foods[:2]:  
    print(i)
```

. Below the code cells, there is a terminal area showing the output of the second cell: "pizza" and "falafel". At the bottom of the terminal area, there is a play button icon and a vertical cursor. On the right side of the terminal area, there are icons for "RAM", "Disk", "Editing", and a caret icon.

# for loop – לולאה מסוג for

The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the file name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a person icon, and "Settings".
- Menu:** "File Edit View Insert Runtime Tools Help".
- Toolbar:** Includes "+ Code" and "+ Text" buttons, a "RAM Disk" indicator with a green checkmark, and an "Editing" mode indicator.
- Code Cell:** Contains the following Python code:

```
[55] falafel  
      hamburger  
      Shawarma  
      Kebab  
  
for e in foods[:2]:  
    print(e)  
  
pizza  
falafel
```
- Output:** The code cell has been executed, resulting in the output:

```
pizza  
falafel
```
- Cell Actions:** A small menu is visible to the right of the code cell, containing icons for "Run", "Up", "Down", "Copy", "Comment", "Settings", "Delete", and "More".



range .8  
for

# 8. range בתוך לולאה מסוג for

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a status indicator "All changes saved". On the right, there are icons for "Comment", "Share", and a user profile. Below the menu, there are tabs for "+ Code" and "+ Text". A status bar at the top right shows "RAM" and "Disk" usage, a "Editing" mode indicator, and a scroll arrow.

The code cell contains the following Python code:

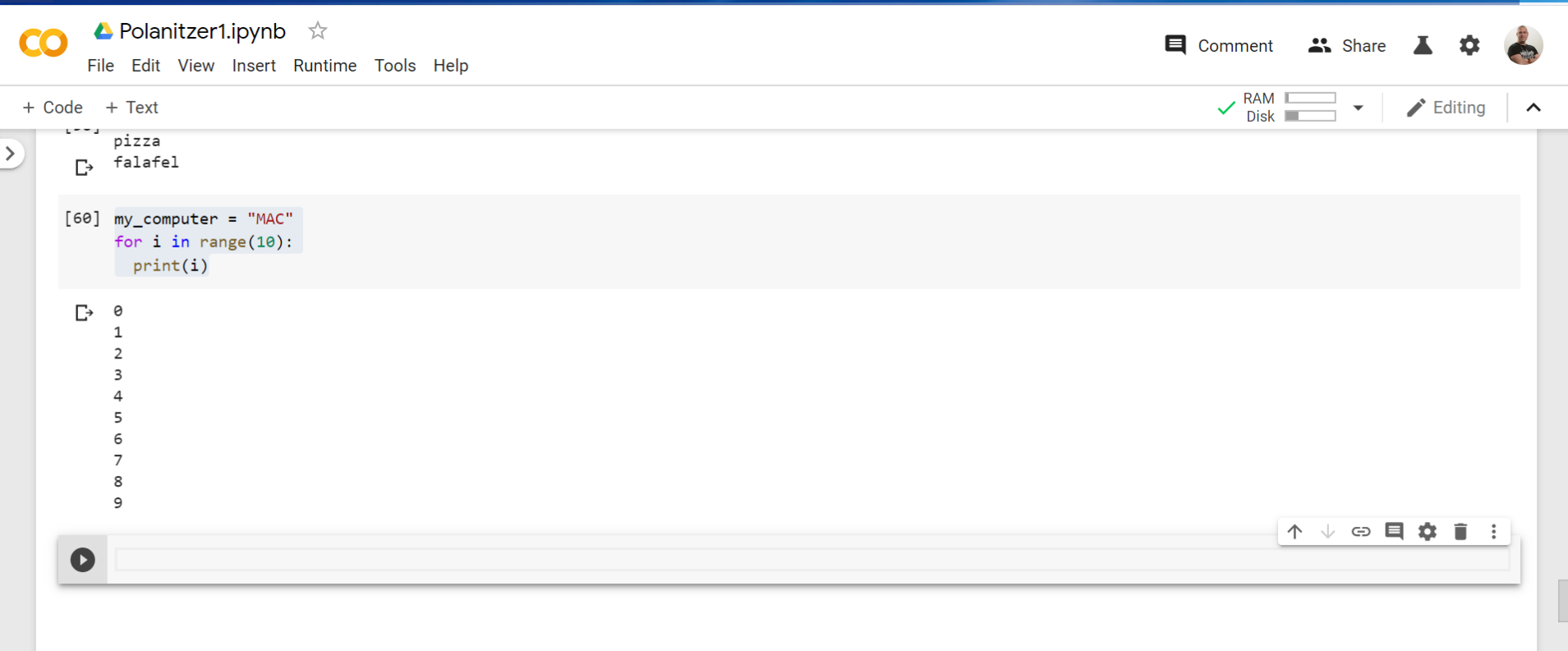
```
[59] my_computer = "MAC"
      for i in range(10):
          print(my_computer)
```

The output of the code cell is ten lines of "MAC":

```
MAC
MAC
MAC
MAC
MAC
MAC
MAC
MAC
MAC
MAC
```

At the bottom of the code cell, there is a play button and a progress bar. To the right of the progress bar, there are icons for "Up", "Down", "Link", "Comment", "Settings", "Trash", and "More".

# 8. range בתוך לולאה מסוג for



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are icons for "Comment", "Share", and a user profile. Below the menu bar, there are tabs for "+ Code" and "+ Text". The main area contains a code cell with the following code:

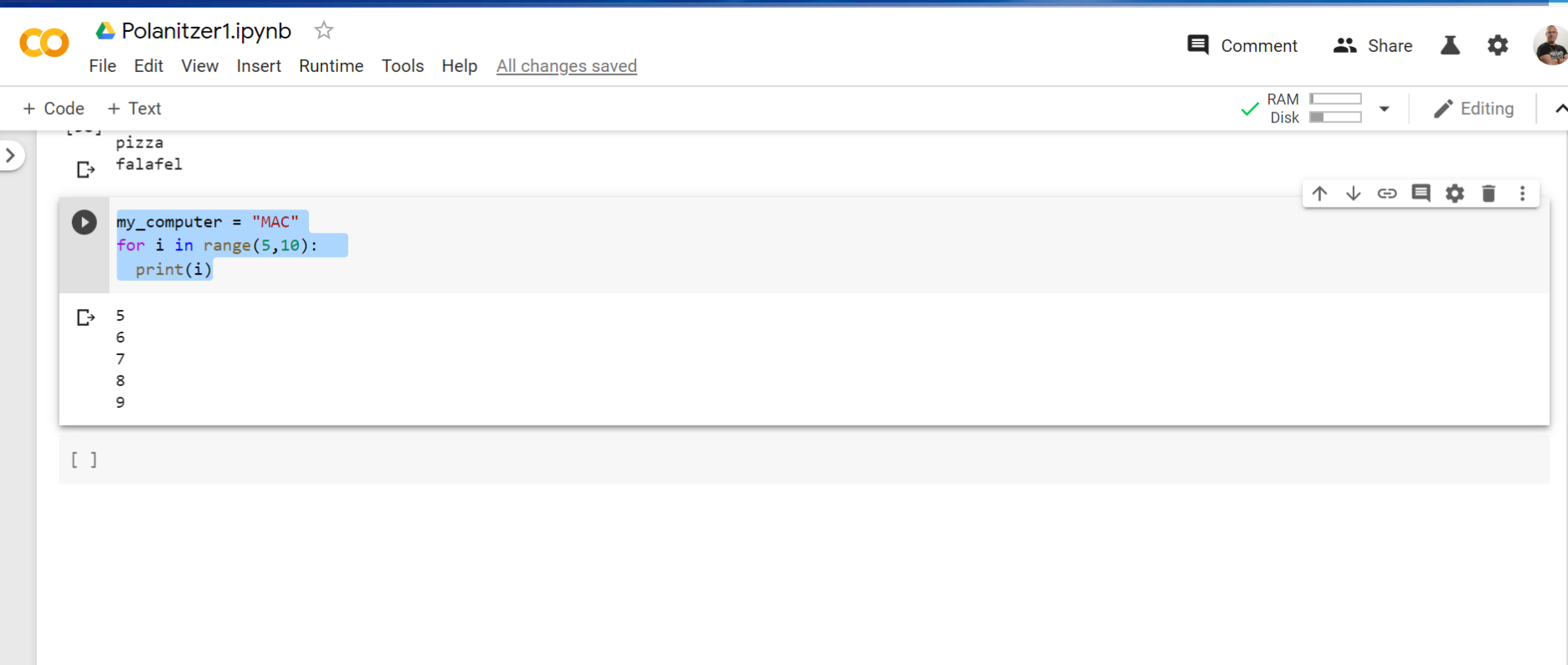
```
[60] my_computer = "MAC"  
     for i in range(10):  
         print(i)
```

The output of the code cell is a list of integers from 0 to 9, displayed vertically:

```
0  
1  
2  
3  
4  
5  
6  
7  
8  
9
```

At the bottom of the notebook, there is a toolbar with icons for "Run", "Up", "Down", "Link", "Comment", "Settings", "Trash", and "More".

# 8. range בתוך לולאה מסוג for



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status bar indicates "All changes saved".
- Right Panel:** Includes "Comment", "Share", "Settings", and a user profile icon. Below these are "RAM" and "Disk" usage indicators, and an "Editing" mode selector.
- Code Cell:** Contains the following Python code:

```
my_computer = "MAC"  
for i in range(5,10):  
    print(i)
```
- Output:** The code cell has been executed, resulting in the following output:

```
5  
6  
7  
8  
9
```
- Bottom Panel:** Shows an empty list representation: `[ ]`.

# 8. range בתוך לולאה מסוג for

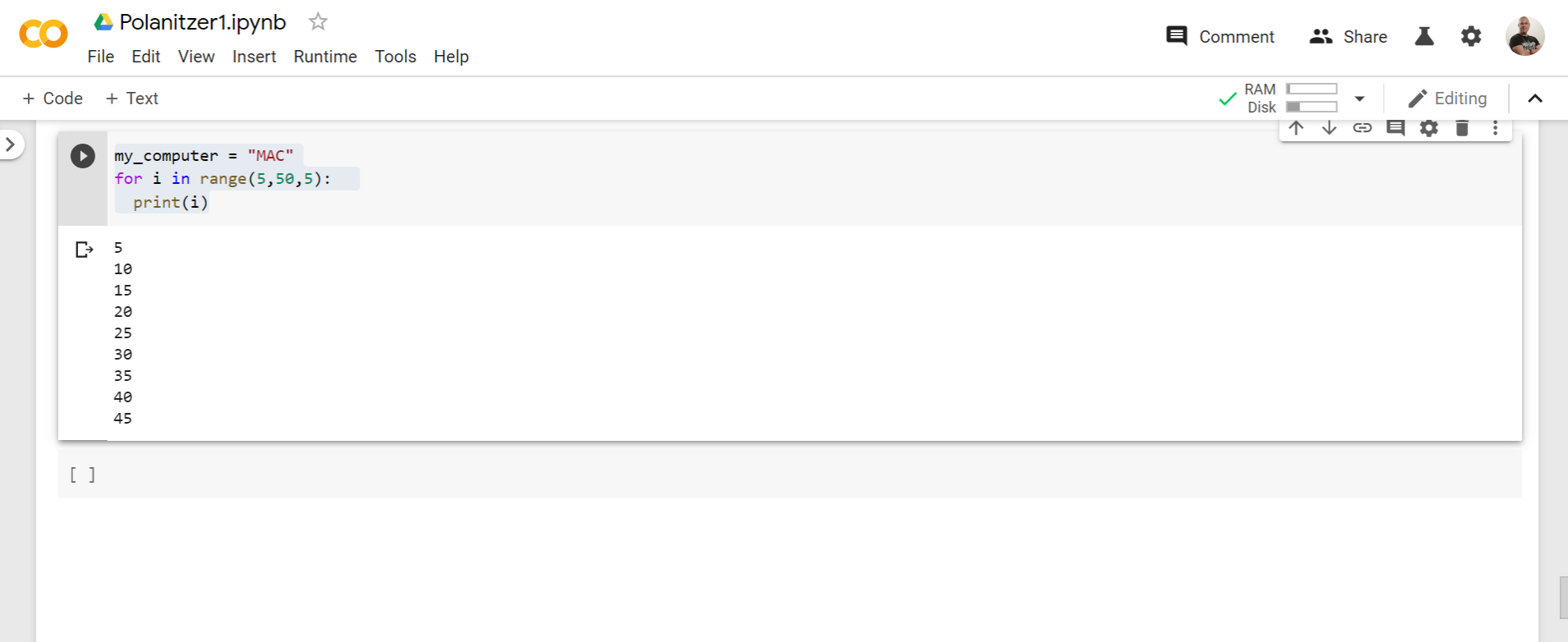
The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right side, there are icons for "Comment", "Share", and a user profile. Below the menu bar, there are controls for "+ Code" and "+ Text", and a status bar showing "RAM" and "Disk" usage, along with an "Editing" mode indicator.

```
[63] my_computer = "MAC"
      for i in range(5,50):
          print(i)
```

The output of the code cell is a list of numbers from 5 to 23, displayed vertically on the left side of the cell.



# 8. range בתוך לולאה מסוג for



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right side, there are icons for "Comment", "Share", and a user profile. Below the menu bar, there are controls for RAM and Disk usage, and an "Editing" mode indicator. The main area contains a code cell with the following Python code:

```
my_computer = "MAC"  
for i in range(5,50,5):  
    print(i)
```

The output of the code cell is a list of numbers from 5 to 45 in increments of 5:

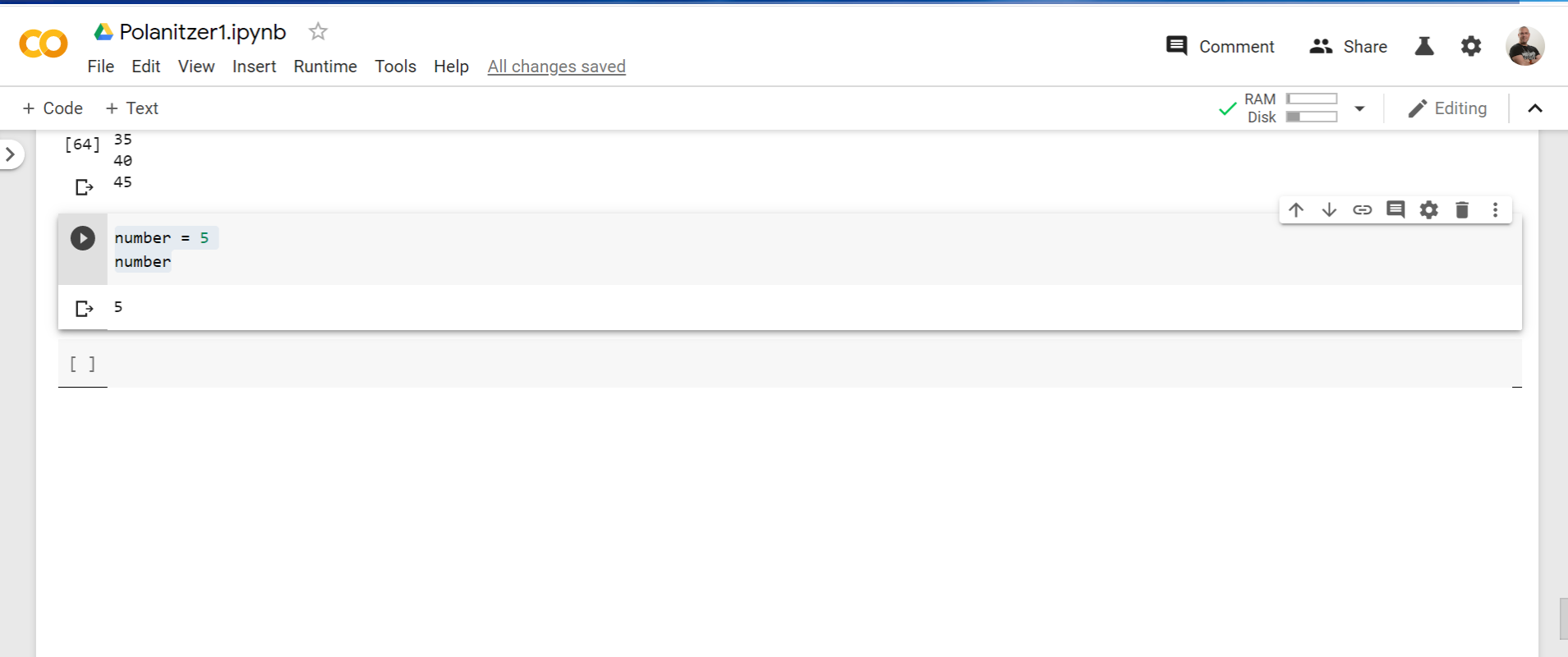
```
5  
10  
15  
20  
25  
30  
35  
40  
45
```

Below the output, there is a small empty list representation: [ ]



# .9 while loop – לולאה מסוג while

# while loop – לולאה מסוג while .9

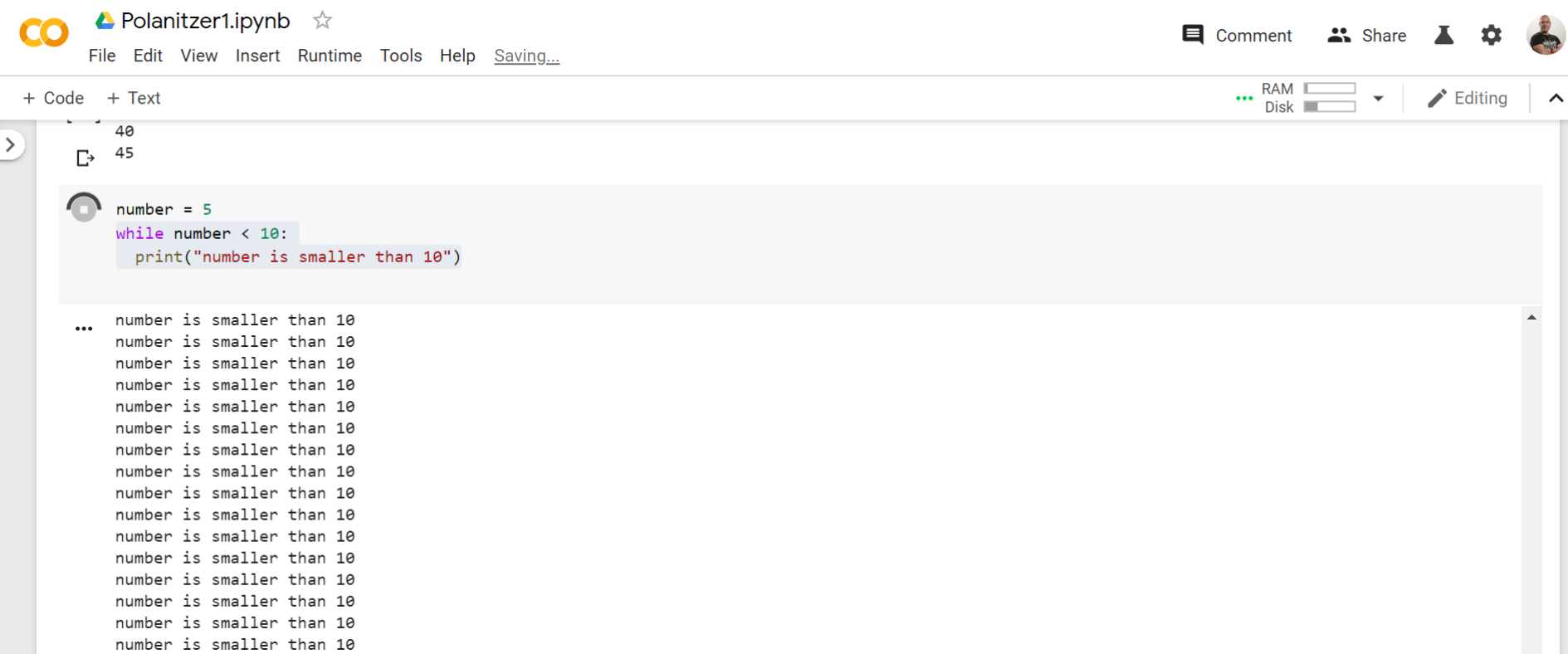


The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "All changes saved".
- Toolbar:** "Comment", "Share", "Settings", and a user profile icon.
- RAM/Disk:** A status bar showing "RAM" and "Disk" usage with progress indicators.
- Code Cell:** A code cell containing the following code:

```
[64] 35  
      40  
      45  
  
▶ number = 5  
  number  
  
↳ 5  
  
[ ]
```
- Cell Actions:** A toolbar for the code cell with icons for "Run", "Download", "Copy", "Comment", "Settings", "Delete", and "More".

# while loop – לולאה מסוג while .9









The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a terminal icon, a settings gear, and a user profile picture.
- Menu Bar:** Includes "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".
- Code Editor:** Shows a code cell with the following Python code:

```
number = 5
while number < 10:
    print("number is smaller than 10")
```
- Output:** Below the code cell, the output shows the string "number is smaller than 10" printed multiple times, with an ellipsis "..." at the beginning of the first line, indicating that the loop continues until the condition is no longer met.
- Right Panel:** Shows resource usage for "RAM" and "Disk" with progress bars, and a status "Editing".

# while loop – לולאה מסוג while .9

 Polanitzer1.ipynb ☆  
File Edit View Insert Runtime Tools Help [Last saved at 5:25 AM](#)

 Comment  Share   

+ Code + Text

✓ RAM   
Disk  Editing 

```
[ ] number = 5  
while number < 10:  
    print(number)  
    number+=1
```

```
↳ 5  
6  
7  
8  
9
```

```
[ ]
```



# 10. functions – פונקציות

# 10. functions – פונקציות

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb" with a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a status message "All changes saved". On the right side, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile picture. Below the menu bar, there are tabs for "+ Code" and "+ Text". A toolbar on the right shows "RAM" and "Disk" usage indicators, an "Editing" mode icon, and a set of navigation icons. The main area contains a code cell with a play button icon and the following Python code:

```
def first_func():  
    print("hello")
```

# 10. functions – פונקציות

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb" with a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are icons for "Comment", "Share", a user profile, and a settings gear. Below the menu bar, there are controls for "+ Code" and "+ Text", a "RAM Disk" indicator with a green checkmark, and an "Editing" mode indicator with a pencil icon. The main area contains a code cell with the following Python code:

```
[3] def first_func():  
    print("hello")  
  
    first_func()
```

Below the code cell, the output is displayed as "hello". At the bottom of the output area, there is a toolbar with icons for up, down, refresh, comment, settings, and delete.



# 10. functions – פונקציות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share

+ Code + Text

✓ RAM  Disk  Editing

```
[3] def first_func():  
    print("hello")  
  
    first_func()
```

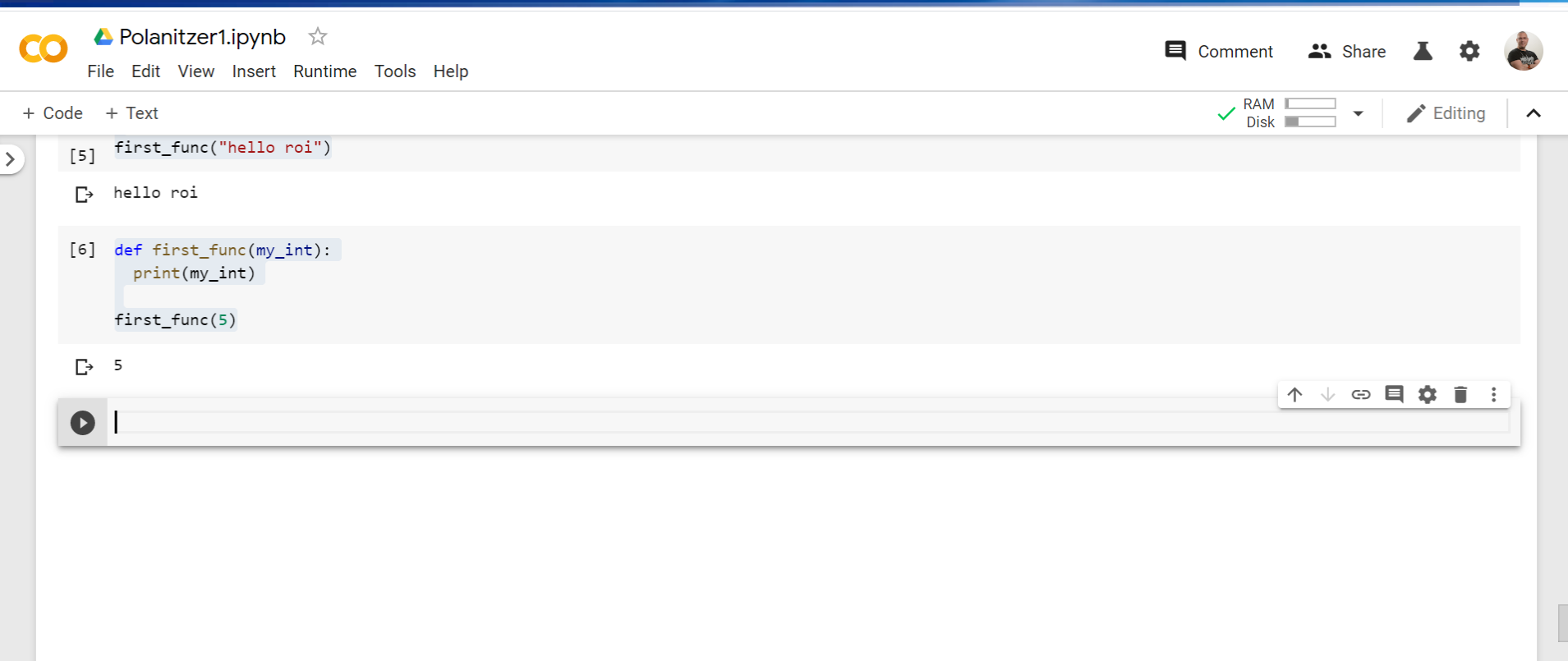
↳ hello

```
[5] def first_func(my_str):  
    print(my_str)  
  
    first_func("hello roi")
```

↳ hello roi



# 10. functions – פונקציות



CO Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share

+ Code + Text RAM Disk Editing

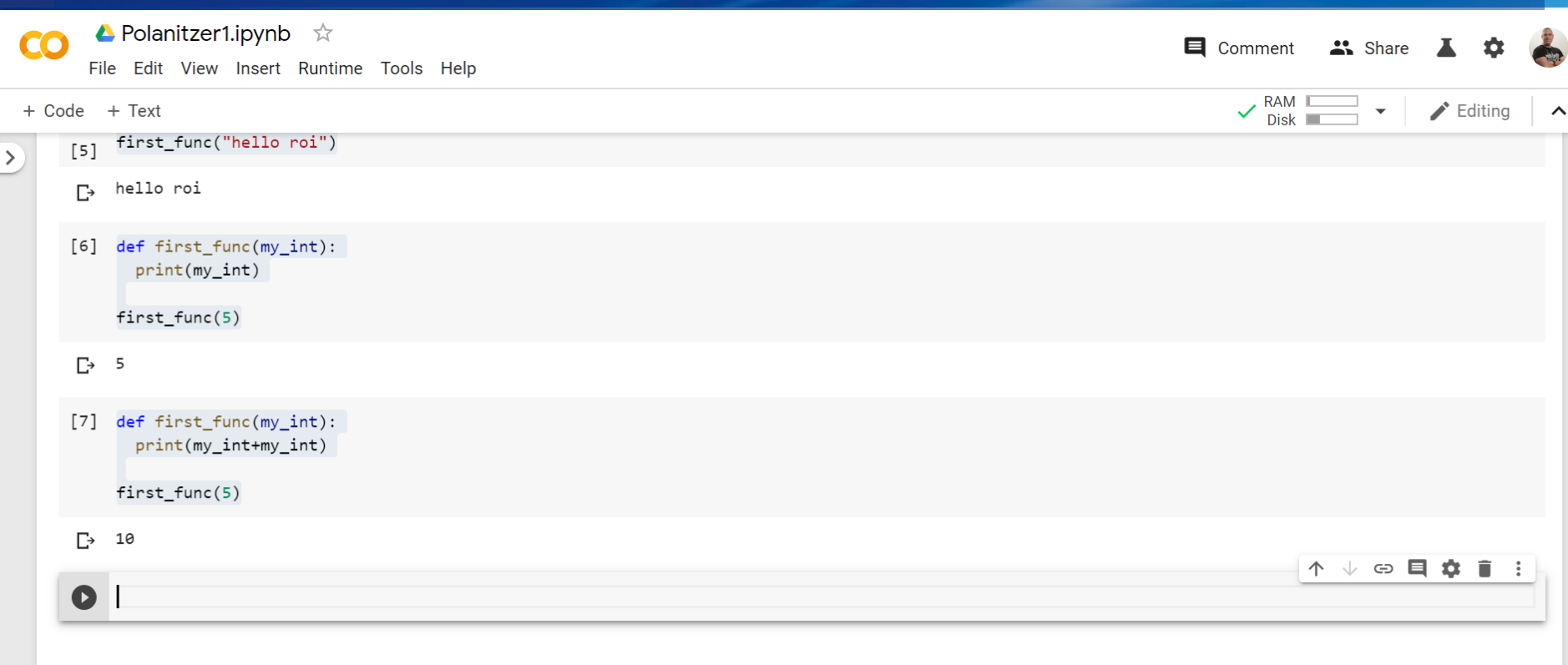
```
[5] first_func("hello roi")
```

```
hello roi
```

```
[6] def first_func(my_int):
    print(my_int)
    first_func(5)
```

```
5
```

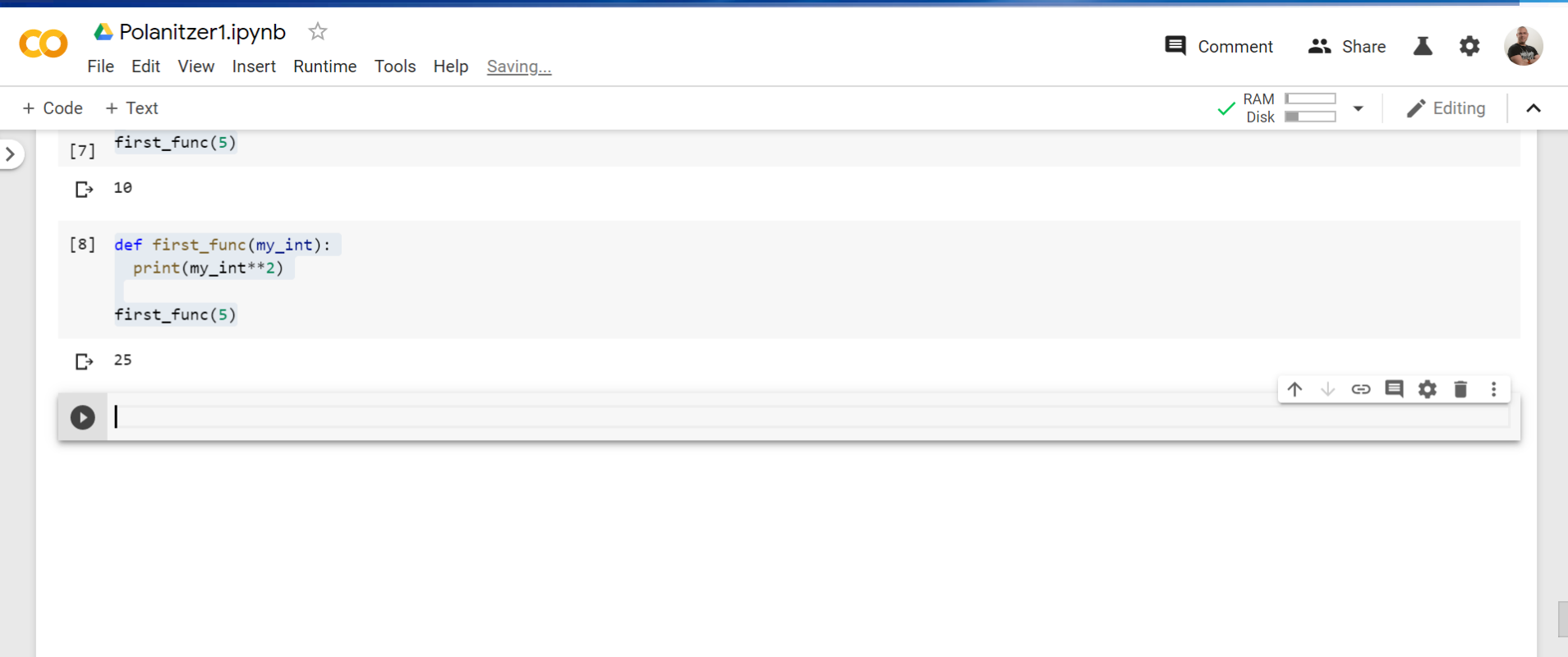
# 10. functions – פונקציות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the filename "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a settings gear, and a user profile picture.
- Menu Bar:** Includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Toolbar:** Shows "+ Code" and "+ Text" buttons, a RAM/Disk usage indicator with a green checkmark, and an "Editing" mode indicator.
- Code Cells:**
  - Cell [5]:** Contains the code `first_func("hello roi")`. The output is `hello roi`.
  - Cell [6]:** Contains the code `def first_func(my_int):`, `print(my_int)`, and `first_func(5)`. The output is `5`.
  - Cell [7]:** Contains the code `def first_func(my_int):`, `print(my_int+my_int)`, and `first_func(5)`. The output is `10`.
- Bottom Bar:** Features a play button and a set of navigation icons (up, down, refresh, comment, settings, trash, and a menu).

# 10. functions – פונקציות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the file name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a person icon, and a settings gear.
- Menu Bar:** Includes "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "Saving...".
- Code Editor:** Shows two code cells. The first cell contains the code `first_func(5)` and has an output of `10`. The second cell contains the code `def first_func(my_int):`, `print(my_int**2)`, and `first_func(5)`, with an output of `25`.
- Right Panel:** Displays system status with a green checkmark, "RAM" and "Disk" usage bars, and a "Editing" mode indicator.
- Bottom Bar:** Features a play button and a vertical cursor line.

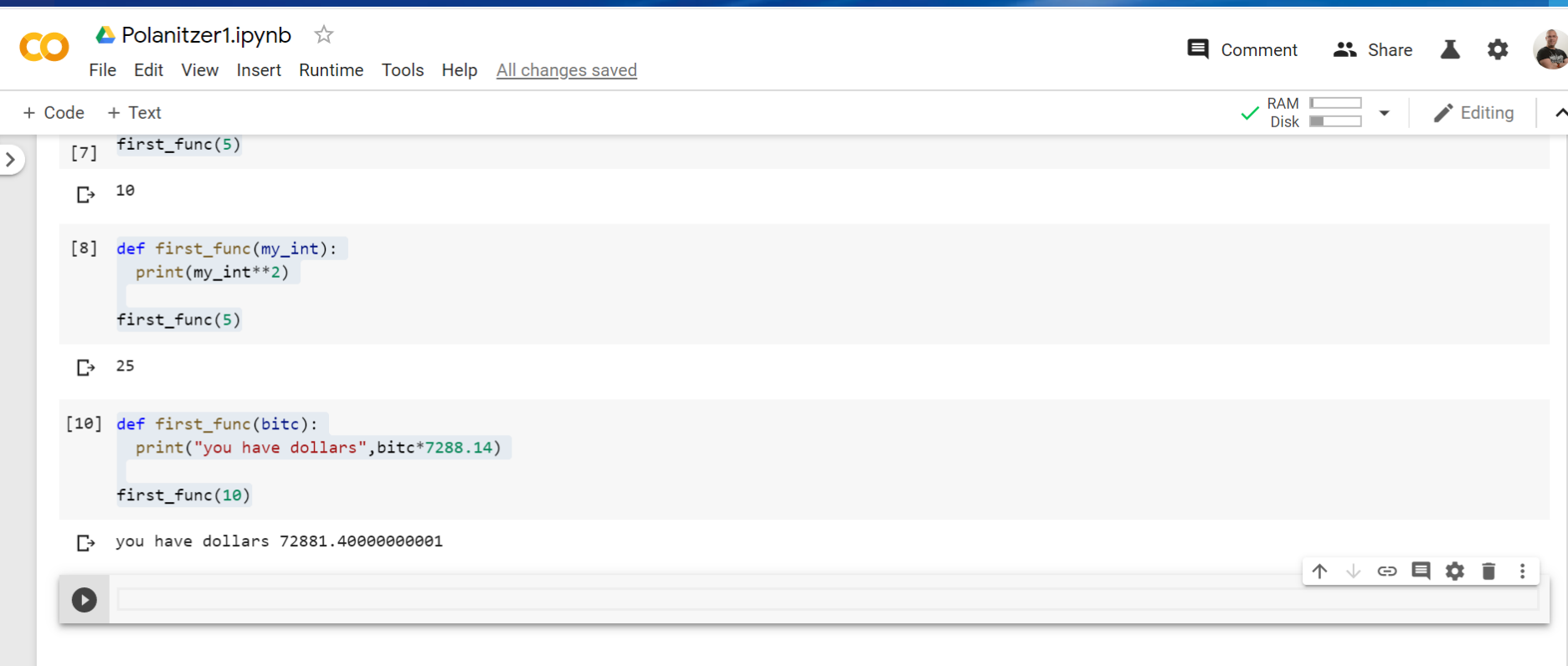
# 10. functions – פונקציות

The screenshot shows the Yahoo Finance website interface. At the top, there's a navigation bar with 'Home', 'Mail', 'News', 'Finance', 'Sports', 'Entertainment', 'Search', 'Mobile', and 'More'. Below this is the 'yahoo! finance' logo and a search bar. The main content area features a row of market indices: S&P 500 (3,226.76, -0.41%), Dow 30 (28,525.64, -0.42%), Nasdaq (8,964.44, -0.47%), Russell 2000 (1,669.87, +0.05%), Crude Oil (61.66, -0.10%), and Gold (1,518.50, +0.03%). Below this is the 'Bitcoin USD (BTC-USD)' section, which includes a 'Quote Lookup' search bar, the current price of 7,288.14 (down 1.74%), and a 'Summary' tab. The summary table provides key metrics: Previous Close (7,417.017), Market Cap (132.144B), Open (7,417.017), Circulating Supply (N/A), Day's Range (7,276.308 - 7,454.824), Max Supply (N/A), 52 Week Range (3,391.02 - 13,796.49), and Volume (23,440,244,736). A line chart shows the price movement over time, with a 'Full screen' button. A 'Data Disclaimer' and 'Help Suggestions' link are also visible.

Index	Value	Change (%)
S&P 500	3,226.76	-0.41%
Dow 30	28,525.64	-0.42%
Nasdaq	8,964.44	-0.47%
Russell 2000	1,669.87	+0.05%
Crude Oil	61.66	-0.10%
Gold	1,518.50	+0.03%

Metric	Value
Previous Close	7,417.017
Open	7,417.017
Day's Range	7,276.308 - 7,454.824
52 Week Range	3,391.02 - 13,796.49
Market Cap	132.144B
Circulating Supply	N/A
Max Supply	N/A
Volume	23,440,244,736

# 10. functions – פונקציות



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Contains the Colab logo, the filename "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask, a gear, and a user profile.
- Menu:** "File Edit View Insert Runtime Tools Help" with a link for "All changes saved".
- Toolbar:** Includes "+ Code + Text", "RAM Disk" status, and "Editing" mode.
- Code Cells:**
  - Cell [7]:** Contains the code `first_func(5)`. The output is `10`.
  - Cell [8]:** Contains the code `def first_func(my_int):`, `print(my_int**2)`, and `first_func(5)`. The output is `25`.
  - Cell [10]:** Contains the code `def first_func(bitc):`, `print("you have dollars",bitc*7288.14)`, and `first_func(10)`. The output is `you have dollars 72881.40000000001`.
- Bottom Bar:** Features a play button and a set of navigation icons (up, down, refresh, comment, gear, trash, and a vertical ellipsis).

# 10. functions – פונקציות



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share

+ Code + Text

RAM Disk Editing

```
[13] def first_func(bitc):  
    print("you have dollars",bitc*7288.14)  
    print("you have dollars",bitc*7288.14)  
    print("you have dollars",bitc*7288.14)  
    print("you have dollars",bitc*7288.14)  
    print("you have dollars",bitc*7288.14)  
    print("you have dollars",bitc*7288.14)
```

```
first_func(10)
```

```
↳ you have dollars 72881.4000000001  
you have dollars 72881.4000000001  
you have dollars 72881.4000000001  
you have dollars 72881.4000000001  
you have dollars 72881.4000000001  
you have dollars 72881.4000000001
```



return .11



# return .11



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[13] first_func(10)
you have dollars 72881.40000000001
you have dollars 72881.40000000001
you have dollars 72881.40000000001
you have dollars 72881.40000000001
you have dollars 72881.40000000001
you have dollars 72881.40000000001
```

```
[14] def sec_func(int):
      print(int*2)
      sec_func(4)
```

8

Navigation icons: up, down, link, comment, settings, trash, menu



# return .11



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text



Editing

```
[13] you have dollars 72881.40000000001  
you have dollars 72881.40000000001  
you have dollars 72881.40000000001
```

```
[14] def sec_func(int):  
    print(int*2)  
  
    sec_func(4)
```

```
8
```

```
[16] def sec_func(int):  
    return(int*2)  
  
    sec = sec_func(4)  
    sec
```

```
8
```



# return .11



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

[16] sec

8

```
[19] def sec_func(int):  
      return(int*2)  
  
      sec = sec_func(4)  
  
      def thrd_func(trd):  
          return(trd/2)  
  
      trdh = thrd_func(sec)  
      trdh
```

4.0





# 12. ערכים דיפולטיביים

# 12. ערכים דיפולטיביים

The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** The notebook name is "Polanitzer1.ipynb" with a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". A status message says "All changes saved". On the right, there are icons for "Comment", "Share", a flask icon, a settings gear, and a user profile picture.
- Toolbar:** On the left, there are buttons for "+ Code" and "+ Text". On the right, there are indicators for "RAM" and "Disk" usage, a "Editing" mode indicator, and a scroll-up arrow.
- Code Cell [19]:** Contains the text "trdh" and the output "4.0".
- Code Cell [20]:** Contains a function definition: 

```
def first_func(num):  
    return(num*2)
```

 followed by the function call `first_func(4)` and the output "8".
- Execution Bar:** At the bottom, there is a play button and a vertical line indicating the current execution position.

# 12. ערכים דיפולטיביים

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are icons for "Comment", "Share", and a user profile. Below the menu bar, there are controls for RAM and Disk usage, and an "Editing" mode indicator.

The main content area shows a code cell with the following Python code:

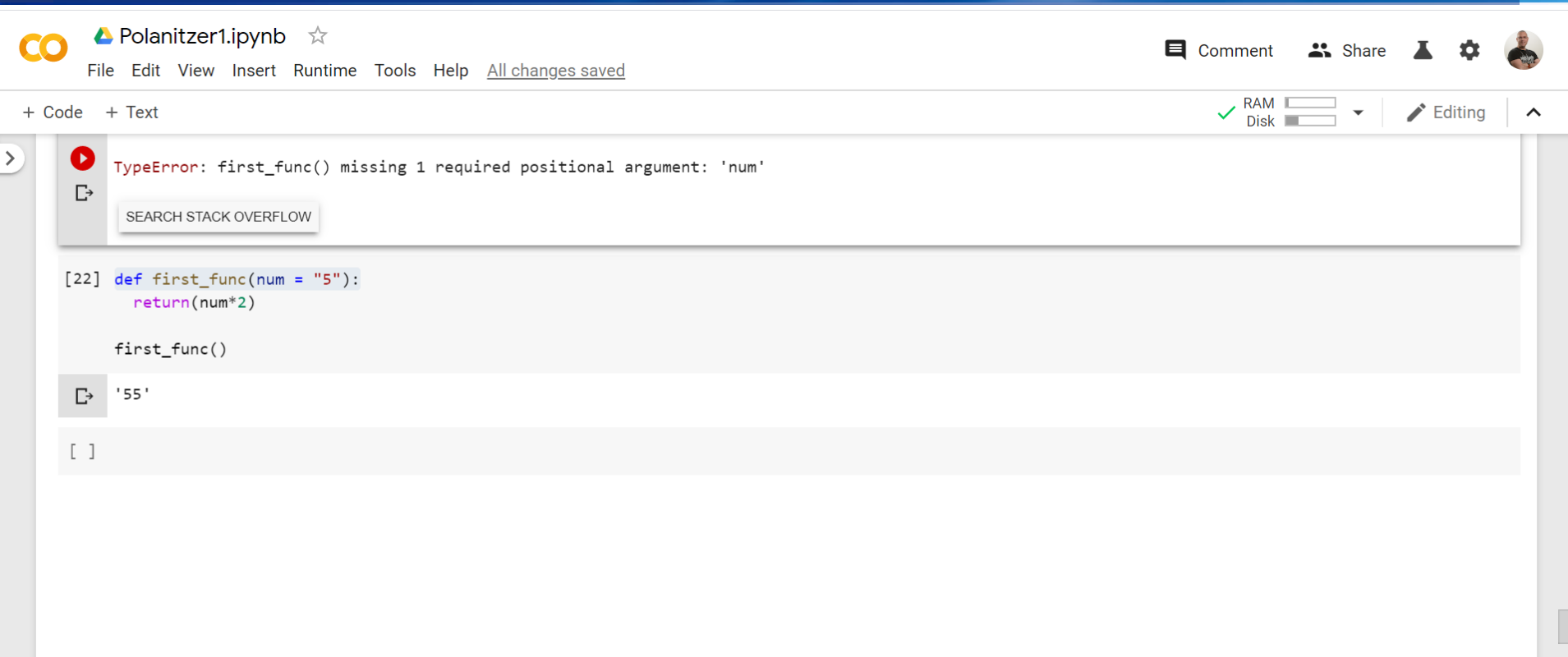
```
[21] def first_func(num):  
    return(num*2)  
  
first_func()
```

Below the code, a red dashed line indicates a traceback. The error message is:

```
TypeError                                 Traceback (most recent call last)  
  <ipython-input-21-39e13d567167> in <module>()  
      2     return(num*2)  
      3  
----> 4 first_func()  
  
TypeError: first_func() missing 1 required positional argument: 'num'
```

At the bottom of the code cell, there is a "SEARCH STACK OVERFLOW" button and a play button icon.

# 12. ערכים דיפולטיביים



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb" and has a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a status "All changes saved". On the right, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile icon.

Below the menu bar, there are controls for "+ Code" and "+ Text". On the right side, there are indicators for "RAM" and "Disk" usage, a "Editing" mode indicator, and a scroll-up arrow.

The main content area shows a code cell with the following Python code:

```
[22] def first_func(num = "5"):  
      return(num*2)  
  
      first_func()
```

Below the code, the output is shown as a string: `'55'`. Above the code, there is a red error message: `TypeError: first_func() missing 1 required positional argument: 'num'`. A search bar with the text "SEARCH STACK OVERFLOW" is positioned below the error message.

# 12. ערכים דיפולטיביים

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment Share Settings Profile

+ Code + Text

RAM Disk Editing

```
[23] def first_func(num = "5"):  
      return(num*2)  
  
      first_func()  
      first_func(4)
```

8

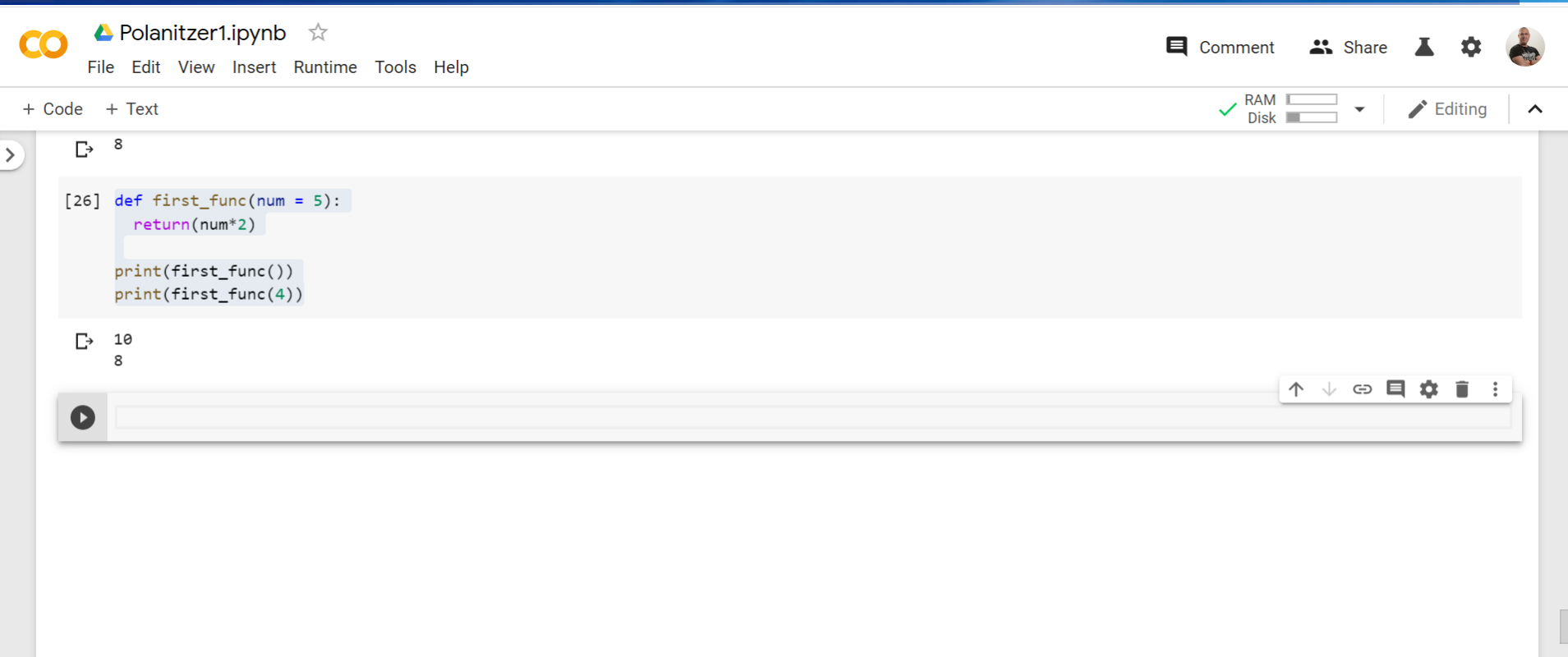
```
[25] def first_func(num = "5"):  
      return(num*2)  
  
      print(first_func())  
      print(first_func(4))
```

55  
8

↑ ↓ 🔗 🗨 ⚙ 🗑 ⋮



# 12. ערכים דיפולטיביים



The screenshot shows a Jupyter Notebook interface. At the top, the file name is "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are icons for "Comment", "Share", a flask icon, a settings gear, and a user profile. Below the menu bar, there are controls for RAM and Disk usage, and a status bar indicating "Editing".

The notebook contains a code cell with the following Python code:

```
[26] def first_func(num = 5):  
    return(num*2)  
  
print(first_func())  
print(first_func(4))
```

The output of the code cell is:

```
10  
8
```

At the bottom of the code cell, there is a toolbar with icons for up, down, link, comment, settings, trash, and a menu.

# 12. ערכים דיפולטיביים

CO Polanitzer1.ipynb ☆

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Comment Share Settings Profile

+ Code + Text RAM Disk Editing

```
[26] def first_func(num = 5):  
      return(num*2)  
  
      print(first_func())  
      print(first_func(4))
```

↳ 10  
8

```
[27] def first_func(num = 0):  
      return(num*2)  
  
      print(first_func())  
      print(first_func(4))
```

↳ 0  
8

↑ ↓ 🔗 🗨 ⚙ 🗑 ⋮



# 13. scope – טווח העבודה עם המשתנים

# 13. scope – טווח העבודה עם המשתנים

The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are icons for "Comment", "Share", a flask icon, a settings gear, and a user profile. Below the menu bar, there are controls for "+ Code" and "+ Text", and a status bar showing "RAM" and "Disk" usage with a green checkmark, and "Editing" mode.

The main area contains a code cell with the following Python code:

```
[28] eat = 33
def pizza():
    print(eat)

def falafel():
    print(eat)

pizza()
falafel()
```

Below the code cell, the output is displayed as:

```
33
33
```

At the bottom of the code cell, there is a toolbar with icons for "Up", "Down", "Copy", "Comment", "Settings", "Trash", and "More".

# 13. scope – טווח העבודה עם המשתנים



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



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Editing



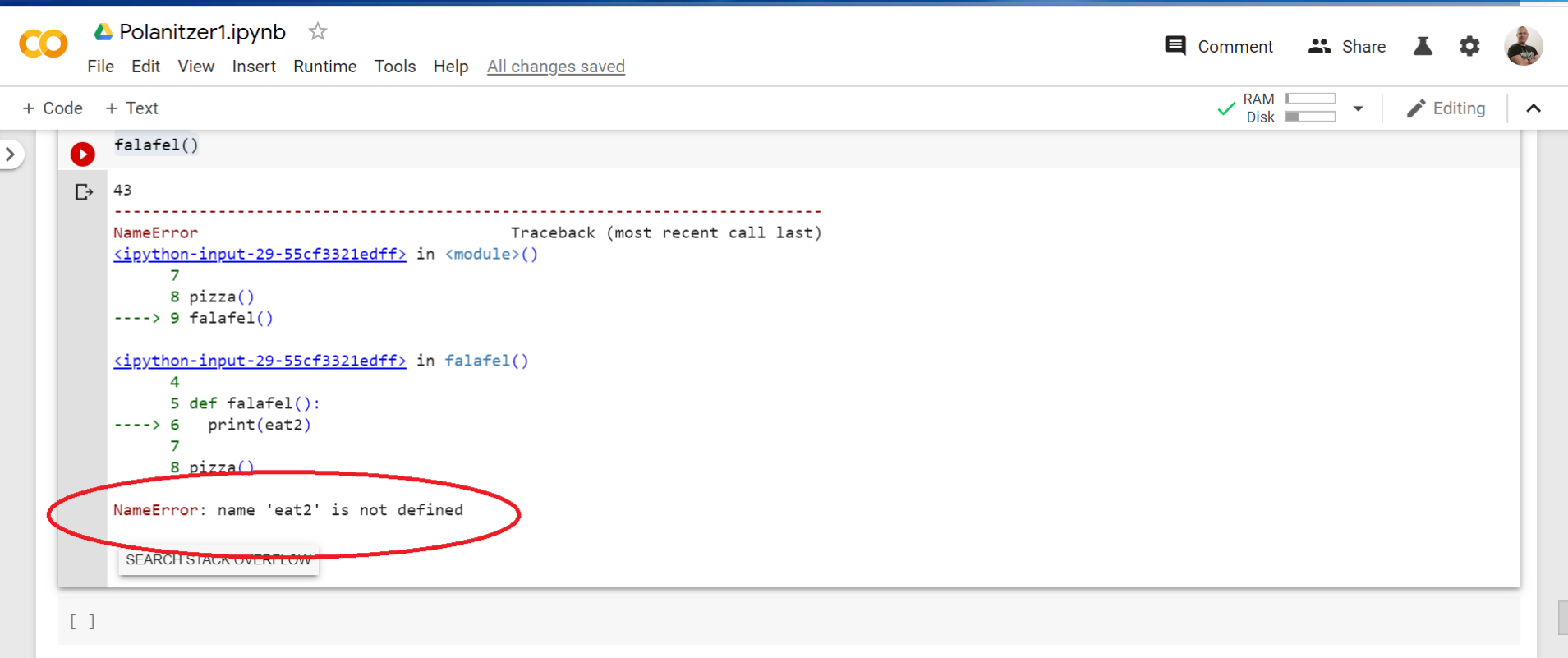
```
▶ def pizza():  
    eat2 = 43  
    print(eat2)  
  
def falafel():  
    print(eat2)  
  
pizza()  
falafel()
```



43

```
-----  
NameError                                Traceback (most recent call last)  
<ipython-input-29-55cf3321edff> in <module>()  
    7  
    8 pizza()  
----> 9 falafel()  
  
<ipython-input-29-55cf3321edff> in falafel()  
    4  
    5 def falafel():  
----> 6     print(eat2)  
    7
```

# 13. scope – טווח העבודה עם המשתנים



The screenshot shows a Jupyter Notebook interface with a code cell containing the following Python code:

```
falafel()  
43  
-----  
NameError                                Traceback (most recent call last)  
<ipython-input-29-55cf3321edff> in <module>()  
7  
8 pizza()  
----> 9 falafel()  
  
<ipython-input-29-55cf3321edff> in falafel()  
4  
5 def falafel():  
----> 6     print(eat2)  
7  
8     pizza()  
  
NameError: name 'eat2' is not defined
```

The error message "NameError: name 'eat2' is not defined" is circled in red. Below the error message is a button labeled "SEARCH STACK OVERFLOW".

The notebook interface includes a top navigation bar with "File Edit View Insert Runtime Tools Help" and "All changes saved". On the right, there are icons for "Comment", "Share", and "Settings". Below the navigation bar, there are controls for "RAM Disk" and "Editing".

# 13. scope – טווח העבודה עם המשתנים

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

+ Code + Text

RAM  Disk  Editing ^

```
[28] print(eat)
      pizza()
      falafel()
```

```
33
33
```

```
def pizza():
    eat2 = 45
    eat3 = 45
    eat4 = 47
    print(eat2)

def falafel():
    print(eat2)

pizza()
falafel()
```

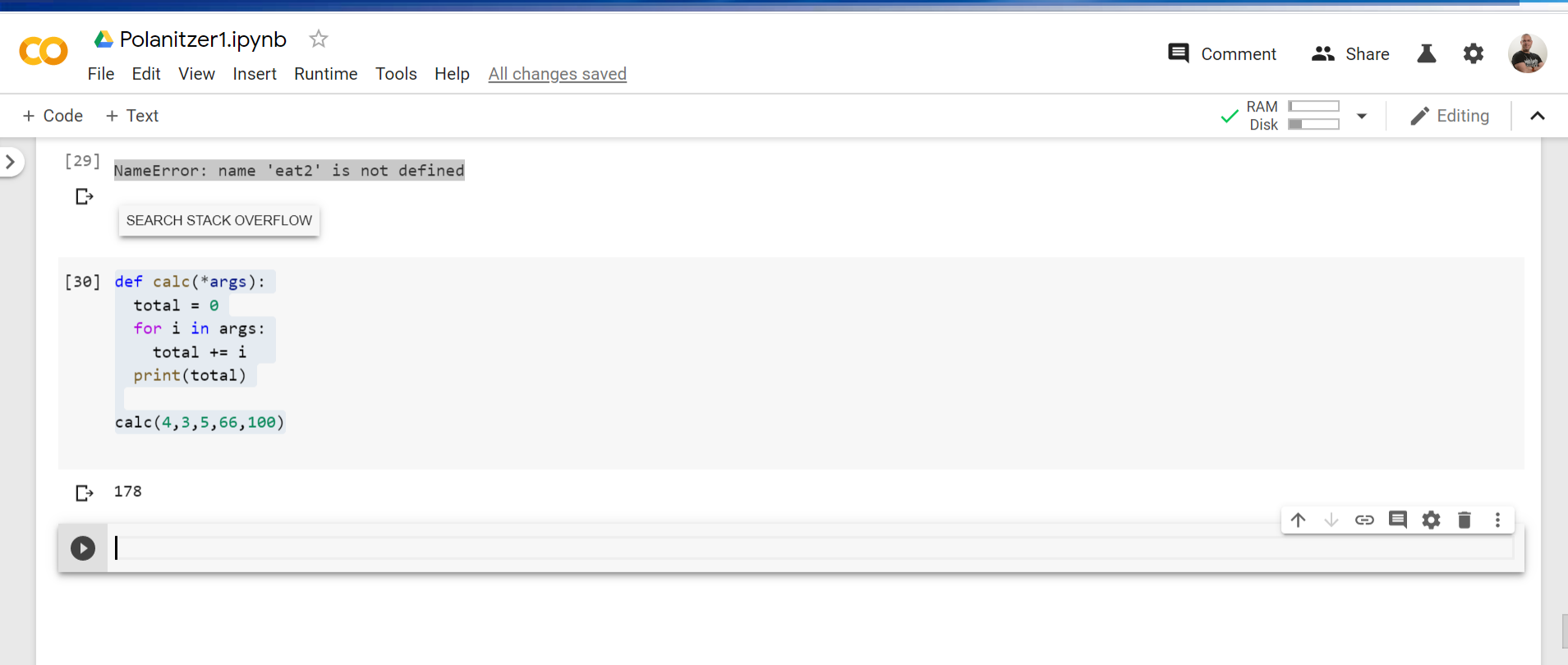
```
43
-----
NameError Traceback (most recent call last)
```



# 14. args\* – רשימה שמורכבת מהרבה מספרים



# 14. \*args – רשימה שמורכבת מהרבה מספרים



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb". The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a status indicator "All changes saved". On the right, there are icons for "Comment", "Share", and a user profile. Below the menu bar, there are controls for RAM and Disk usage, and an "Editing" mode indicator.

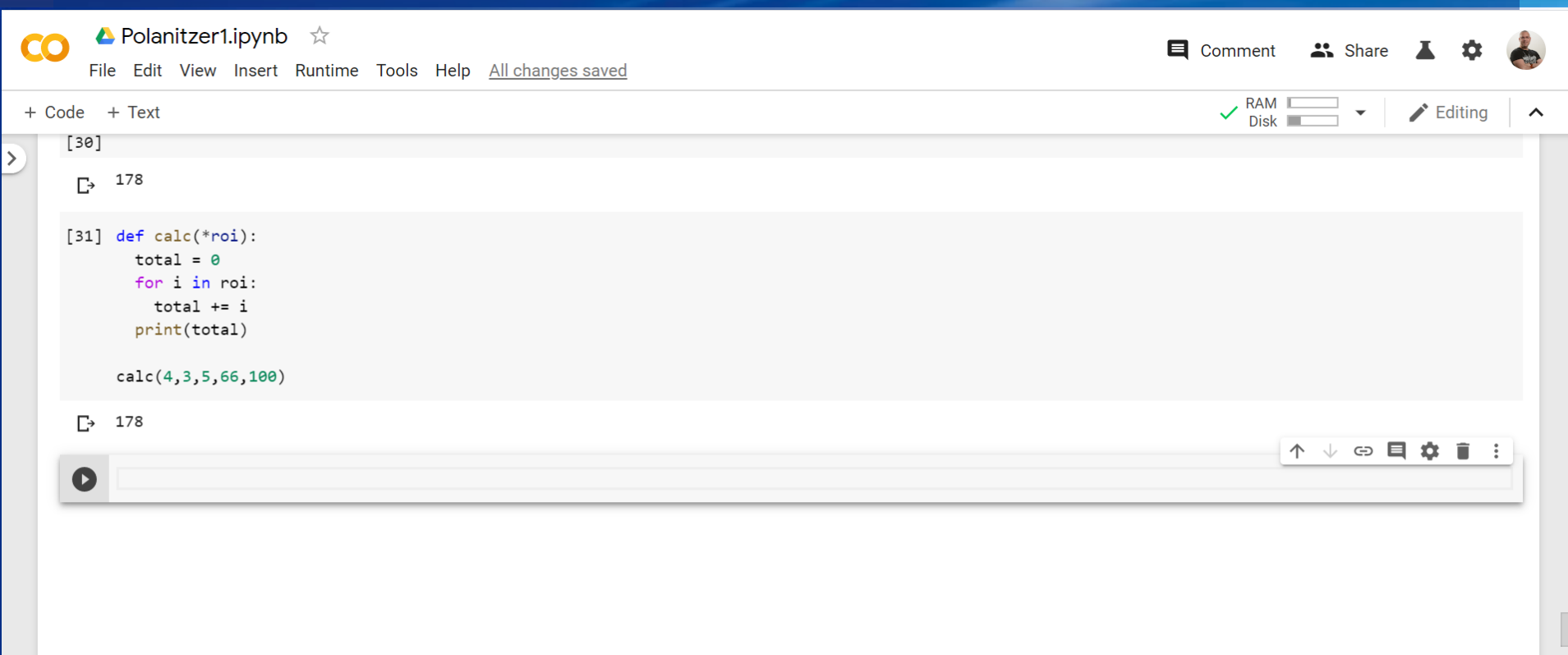
The notebook content shows two code cells:

- Cell [29]: A `NameError: name 'eat2' is not defined` message. Below it is a search bar with the text "SEARCH STACK OVERFLOW".
- Cell [30]: A Python function definition and a call to the function:

```
def calc(*args):  
    total = 0  
    for i in args:  
        total += i  
    print(total)  
  
calc(4,3,5,66,100)
```

At the bottom of the notebook, there is a toolbar with icons for navigation and a play button. The number "178" is visible in the bottom left corner of the notebook area.

# 14. \*args – רשימה שמורכבת מהרבה מספרים



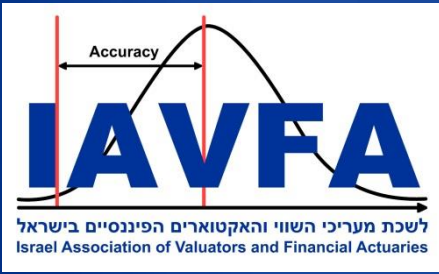
The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and "All changes saved".
- Right Panel:** "Comment", "Share", "RAM", "Disk", "Editing", and a user profile icon.
- Code Cell:** A code cell with the following Python code:

```
[30] 178

[31] def calc(*roi):
    total = 0
    for i in roi:
        total += i
    print(total)

    calc(4,3,5,66,100)
```
- Output:** The output of the code cell is "178".
- Bottom Panel:** A toolbar with icons for "Up", "Down", "Link", "Comment", "Settings", "Trash", and "More".



unpack args .15

# unpack args .15



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

```
[ ]  
print(total)  
calc(4,3,5,66,100)
```

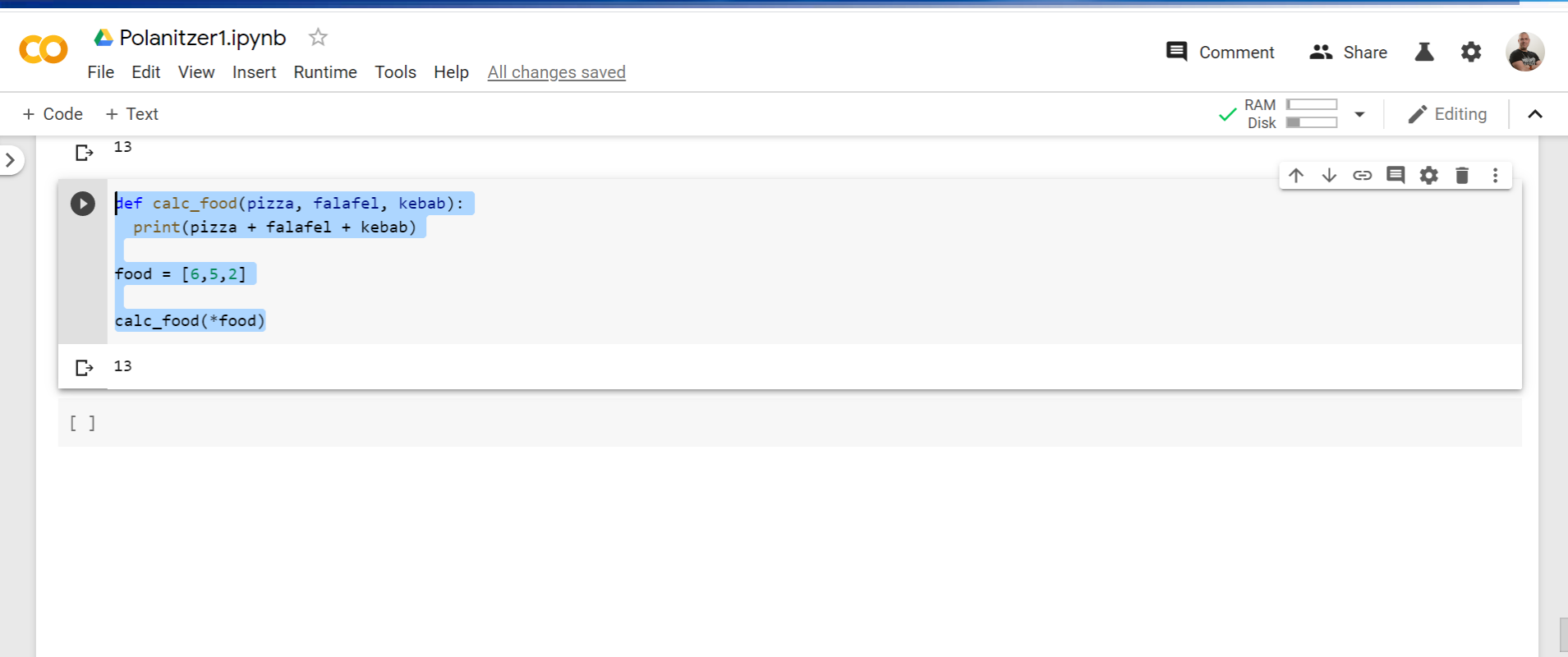
↳ 178

```
▶ def calc_food(pizza, falafel, kebab):  
    print(pizza + falafel + kebab)  
  
    food = [6,5,2]  
    calc_food(food[0],food[1],food[2])
```

↳ 13

```
[ ]
```

# unpack args .15



The screenshot shows a Jupyter Notebook interface. At the top, the notebook is titled "Polanitzer1.ipynb" and has a star icon. The menu bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help", with a link for "All changes saved". On the right side, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile picture. Below the menu bar, there are controls for RAM and Disk usage, and a status indicator for "Editing". The main area contains a code cell with the following Python code:

```
def calc_food(pizza, falafel, kebab):  
    print(pizza + falafel + kebab)  
  
food = [6,5,2]  
  
calc_food(*food)
```

Below the code cell, there is an output area showing the number "13" and an empty list "[ ]".



sets .16

# sets .16

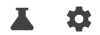


Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

13

```
[7] drinks = {'coffee', 'water', 'orange juice', 'water'}  
print(drinks)
```

```
{'orange juice', 'water', 'coffee'}
```



# sets .16



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM  
Disk

Editing

13

```
[8] drinks = {'coffee', 'water', 'orange juice', 'water'}  
if 'coffee' in drinks:  
    print("this is morning")  
else:  
    print("this is not morning")
```

this is morning







# Dictionary .17

# Dictionary .17



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

✓ RAM  
Disk

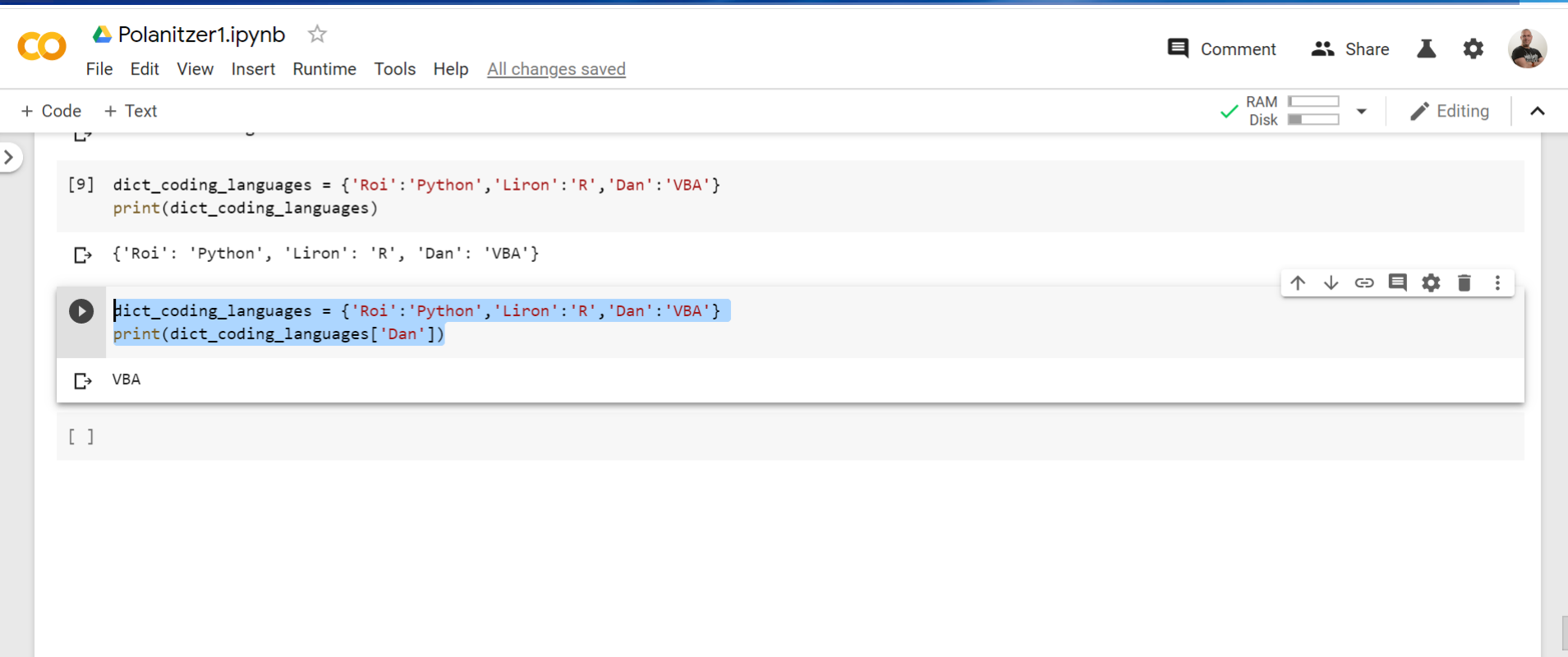
Editing

```
[9] dict_coding_languages = {'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}  
    print(dict_coding_languages)
```

```
{'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}
```



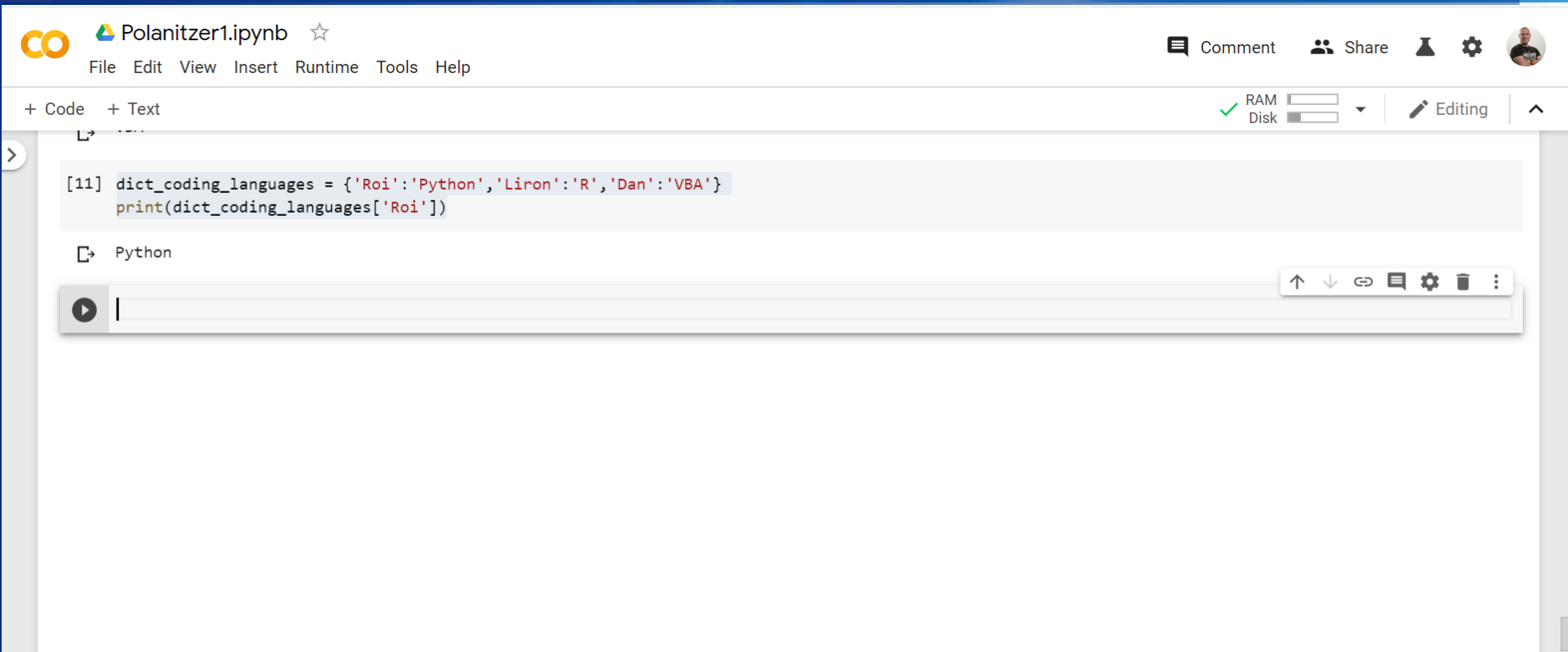
# Dictionary .17



The screenshot shows a Jupyter Notebook interface with the following elements:

- Top Bar:** Includes the Colab logo, the notebook name "Polanitzer1.ipynb", and a star icon. On the right, there are icons for "Comment", "Share", a flask icon, a gear icon, and a user profile icon.
- Menu Bar:** Contains "File", "Edit", "View", "Insert", "Runtime", "Tools", "Help", and a link for "All changes saved".
- Toolbar:** On the left, there are "+ Code" and "+ Text" buttons. On the right, there are "RAM" and "Disk" indicators, an "Editing" mode indicator, and an upward arrow.
- Code Cell 1:** Contains the code `dict_coding_languages = {'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}` followed by `print(dict_coding_languages)`. The output is a dictionary: `{'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}`.
- Code Cell 2:** Contains the code `dict_coding_languages = {'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}` followed by `print(dict_coding_languages['Dan'])`. The output is the string `VBA`.
- Code Cell 3:** Contains an empty list `[ ]`.

# Dictionary .17



The screenshot shows a Jupyter Notebook interface with the following elements:

- Header:** "Polanitzer1.ipynb" with a star icon, and a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help".
- Right Panel:** "Comment", "Share", a user profile icon, "RAM" and "Disk" usage indicators, and an "Editing" mode selector.
- Code Cell:** A code cell containing the following Python code:

```
[11] dict_coding_languages = {'Roi': 'Python', 'Liron': 'R', 'Dan': 'VBA'}  
print(dict_coding_languages['Roi'])
```
- Output:** The output of the code cell is "Python".
- Cell Controls:** A toolbar with a play button, a vertical line, and icons for up/down arrows, link, comment, settings, and trash.

# Dictionary .17



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

RAM   
Disk

Editing

python

```
[14] dict_coding_languages = {'Roi':'Python','Liron':'R','Dan':'VBA'}  
for k,v in dict_coding_languages.items():  
    print(k+v)
```

```
RoiPython  
LironR  
DanVBA
```



# Dictionary .17



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help

Comment

Share



+ Code + Text

RAM   
Disk

Editing

python

```
[13] dict_coding_languages = {'Roi':'Python','Liron':'R','Dan':'VBA'}  
for k,v in dict_coding_languages.items():  
    print(k + ' ' + v)
```

```
Roi Python  
Liron R  
Dan VBA
```







# Import .18

# Import .18

Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share 

Code + Text RAM  Disk  Editing 

```
[ ] Roi Python
↳ Liron R
Dan VBA

[ ] dict_coding_languages = {'Liron':'Python','Roi':'R','Dan':'VBA'}
for k,v in dict_coding_languages.items():
    print(k+' '+v)

↳ Liron Python
Roi R
Dan VBA

[3] import numpy
numpy.exp(-0.05)

↳ 0.951229424500714
```



# Import .18

+ Code + Text

RAM  Disk  Editing ^

[ ] Liron Python  
Roi R  
Dan VBA

```
[3] import numpy  
numpy.exp(-0.05)
```

0.951229424500714

```
[4] numpy.sqrt(9)
```

3.0

# Import .18



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM   
Disk

Editing



```
[3] numpy.exp(-0.05)
```

```
0.951229424500714
```

```
[4] numpy.sqrt(9)
```

```
3.0
```

```
[10] import scipy.stats  
      scipy.stats.norm.cdf(1.645, 0.0, 1.0)
```

```
0.9500150944608786
```

# Import .18



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share

+ Code + Text

✓ RAM  Disk  Editing

```
[10] import scipy.stats  
     scipy.stats.norm.cdf(1.645, 0.0, 1.0)
```

```
↳ 0.9500150944608786
```

```
[11] import scipy.stats  
     scipy.stats.norm.ppf(0.95, 0.0, 1.0)
```

```
↳ 1.6448536269514722
```

# Import .18



Polanitzer1.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment

Share



+ Code + Text

✓ RAM   
Disk

Editing

```
[13] import random  
     random.randrange(1,1000)
```

↳ 179

```
[14] import random  
     random.randrange(1,1000)
```

↳ 134

```
[15] import random  
     random.randrange(1,1000)
```

↳ 827





# 19. פיתוח קודים לתמחור נכסים פיננסיים

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ להלן נוסחת (1874) Makeham להערכת שווי איגרת חוב סטרייט בסיסית שבה הקופונים משולמים מידי שנה והקרן נפדית במועד הפדיון בלבד:

$$\text{Bond Value} = d_1 + d_2 \cdot (1 + y)^{(N-T)}$$

כאשר:

$$d_1 = \frac{F}{(1+y)^T}, \quad d_2 = (F \cdot c) \cdot \frac{[1 - (1+y)^{(-N)}]}{y}$$

כאשר:

$T$  - הטווח לפדיון של האיגרת בשנים

$F$  - הערך הנקוב

$N$  - מספר הקופונים שנשאר לאיגרת לשלם

$c$  - שיעור הריבית הנקובה השנתית

$y$  - שיעור התשואה לפדיון השנתי

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[24] def PolanitzerBond(Maturity, FaceValue, CouponRate, CouponNumber, YtM):  
    d1 = FaceValue / (1 + YtM) ** Maturity  
    d2 = (FaceValue * CouponRate) * ((1 - (1 + YtM) **(-CouponNumber)) / YtM)  
    PolanitzerBond = d1 + (d2 *(1 + YtM) ** (CouponNumber - Maturity))  
    return(PolanitzerBond)
```

## 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ כמה שווה איגרת חוב סטרייט שנשארו לה עוד 3 קופונים לשלם, בעלת ערך נקוב של 100 אגורות, ריבית קופון שנתית של 4% וטווח לפדיון של 2.25 שנים, אם שיעור התשואה השנתי הנדרש על ידי המשקיעים בשוק כיום עומד על 3%?



# 19. פיתוח קודים לתמחור נכסים פיננסיים

File Edit View Insert Runtime Tools Help All changes saved

+ Code + Text

```
[25] def PolanitzerBond(Maturity, FaceValue, CouponRate, CouponNumber, YtM):  
    d1 = FaceValue / (1 + YtM) ** Maturity  
    d2 = (FaceValue * CouponRate) * ((1 - (1 + YtM) ** (-CouponNumber)) / YtM)  
    PolanitzerBond = d1 + (d2 * (1 + YtM) ** (CouponNumber - Maturity))  
    return(PolanitzerBond)  
  
PolanitzerBond(2.25,100,0.04,3,0.03)
```

☞ 105.13368560316525

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ להלן נוסחה להערכת שווי עסקת אקדמה (Forward) על נכס מניב תשואה במועד הקמת העסקה:

$$F_0^T = S_0 \cdot e^{[(r-q) \cdot T]}$$

כאשר:

$-q$  שיעור התשואה השנתית שמניב הנכס (במטבע הבסיסי)

$-F_0^T$  המחיר העתידי של עסקת אקדמה בעת ביצוע העסקה

$-T$  הטווח לפקיעה, משך הזמן עד לפקיעת העסקה

$-S_0$  מחיר נכס הבסיס בעת ביצוע העסקה (שער הספוט)

$-r$  שיעור הריבית השנתית חסרת הסיכון במטבע התשלום

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[29] import numpy as np
def PolanitzerForwardPrice(Maturity, Spot, RiskFree, Yield):
    PolanitzerForwardPrice = Spot * np.exp((RiskFree - Yield) * Maturity)
    return(PolanitzerForwardPrice)
```

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ מהו המחיר העתידי של עסקת אקדמה שקל-דולר לחצי שנה, אם ידוע כי שער הספוט עומד על 4.6 שקלים לדולר ארה"ב, הריבית השקלית השנתית הינה 5.0% והריבית הדולרית השנתית הינה 3.0%?

# 19. פיתוח קודים לתמחור נכסים פיננסיים

File Edit View Insert Runtime Tools Help All changes saved

+ Code + Text

```
[30] import numpy as np
def PolanitzerForwardPrice(Maturity, Spot, RiskFree, Yield):
    PolanitzerForwardPrice = Spot * np.exp((RiskFree - Yield) * Maturity)
    return(PolanitzerForwardPrice)

PolanitzerForwardPrice(0.5, 4.6, 0.05, 0.03)
```

```
↳ 4.646230768587172
```

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ להלן נוסחה להערכת שווי עסקת אקדמה (Forward) על נכס מניב תשואה במהלך חיי העסקה:

$$V_t = S_t \cdot e^{(-q \cdot t)} - F_0^T \cdot e^{(-r \cdot t)}$$

$-F_0^T$  המחיר העתידי של עסקת אקדמה בעת ביצוע העסקה

$-S_t$  מחיר נכס הבסיס בעת הערכת השווי

$-r$  שיעור הריבית השנתית חסרת הסיכון בעת הערכת השווי

$-q$  שיעור התשואה השנתית שמניב הנכס בעת הערכת השווי

$-t$  משך החיים שנותר לעסקת האקדמה

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[33] import numpy as np
def PolanitzerForwardValue(Maturity, Spot, ForwardPrice, RiskFree, Yield):
    PolanitzerForwardValue = Spot * np.exp(- Yield * Maturity) - ForwardPrice * np.exp(- RiskFree * Maturity)
    return(PolanitzerForwardValue)
```

## 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ מהו השווי ההוגן של עסקת אקדמה שקל-דולר שלושה חודשים לפני פקיעתה, אם ידוע כי שער הספוט ירד ל- 4.5 שקלים לדולר ארה"ב, המחיר העתידי הוא 4.646231 שקלים לדולר ארה"ב הריבית השקלית השנתית הינה 5.0% והריבית הדולרית השנתית הינה 3.0%?



# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[34] import numpy as np
def PolanitzerForwardValue(Maturity, Spot, ForwardPrice, RiskFree, Yield):
    PolanitzerForwardValue = Spot * np.exp(- Yield * Maturity) - ForwardPrice * np.exp(- RiskFree * Maturity)
    return(PolanitzerForwardValue)

PolanitzerForwardValue(0.25, 4.5, 4.646231, 0.05, 0.03)
```

↳ -0.12213834488036479

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ להלן נוסחת Black & Scholes (1973) להערכת שווי אופציית רכש (Call) על נכס מניב תשואה:

$$Call = S \cdot e^{(-q \cdot t)} \cdot N(d_1) - K \cdot e^{(-r \cdot t)} \cdot N(d_2)$$

כאשר:

$$d_1 = \frac{\ln(S/K) + (r - q + 0.5 \cdot \sigma^2) \cdot T}{\sigma \cdot \sqrt{T}} \quad d_2 = \frac{\ln(S/K) + (r - q - 0.5 \cdot \sigma^2) \cdot T}{\sigma \cdot \sqrt{T}}$$

# 19. פיתוח קודים לתמחור נכסים פיננסיים

כאשר:

$Call$  - שווי אופציית רכש

$S$  - מחיר נכס הבסיס במועד הערכת השווי

$K$  - מחיר המימוש של האופציה

$T$  - משך חיי האופציה

$r$  - שיעור הריבית השנתית חסרת הסיכון למשך חיי האופציה

$q$  - שיעור התשואה השנתית שמניב הנכס למשך חיי האופציה

$\sigma$  - סטיית התקן השנתית של תשואות מחירי נכס הבסיס

$N(d)$  פונקציית ההתפלגות המצטברת הנורמלית סטנדרטית עד לנקודה  $d$

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
import numpy as np
import scipy.stats as si
def PolanitzerCallValue(Maturity, Spot, Strike, RiskFree, Yield, Volatility):
    d1 = (np.log(Spot / Strike) + (RiskFree - Yield + 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    d2 = (np.log(Spot / Strike) + (RiskFree - Yield - 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    PolanitzerCallValue = Spot*np.exp(-Yield*Maturity)*si.norm.cdf(d1,0.0,1.0)-Strike*np.exp(-RiskFree*Maturity)*si.norm.cdf(d2,0.0,1.0)
    return(PolanitzerCallValue)
```

## 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ מהו השווי ההוגן של אופציית Call לשנתיים, אם ידוע כי שער הספוט הינו 4.5 שקלים לדולר ארה"ב, מחיר המימוש הינו 4.6 שקלים לדולר ארה"ב, סטיית התקן השנתית של תשואות שע"ח שקל-דולר היא 20%, הריבית השקלית השנתית הינה 5.0% והריבית הדולרית השנתית הינה 3.0%?

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[39] import numpy as np
import scipy.stats as si
def PolanitzerCallValue(Maturity, Spot, Strike, RiskFree, Yield, Volatility):
    d1 = (np.log(Spot / Strike) + (RiskFree - Yield + 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    d2 = (np.log(Spot / Strike) + (RiskFree - Yield - 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    PolanitzerCallValue = Spot*np.exp(-Yield*Maturity)*si.norm.cdf(d1,0.0,1.0)-Strike*np.exp(-RiskFree*Maturity)*si.norm.cdf(d2,0.0,1.0)
    return(PolanitzerCallValue)

PolanitzerCallValue(2, 4.5, 4.6, 0.05, 0.03, 0.2)
```

0.5111512454194613

# 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ להלן נוסחת Black & Scholes (1973) להערכת שווי אופציית מכר (Put) על נכס מניב תשואה:

$$Put = K \cdot e^{(-r \cdot t)} \cdot N(-d_2) - S \cdot e^{(-q \cdot t)} \cdot N(-d_1)$$

כאשר:

$$d_1 = \frac{\ln(S/K) + (r - q + 0.5 \cdot \sigma^2) \cdot T}{\sigma \cdot \sqrt{T}} \quad d_2 = \frac{\ln(S/K) + (r - q - 0.5 \cdot \sigma^2) \cdot T}{\sigma \cdot \sqrt{T}}$$

# 19. פיתוח קודים לתמחור נכסים פיננסיים

כאשר:

$Put$  - שווי אופציית מכר

$S$  - מחיר נכס הבסיס במועד הערכת השווי

$K$  - מחיר המימוש של האופציה

$T$  - משך חיי האופציה

$r$  - שיעור הריבית השנתית חסרת הסיכון למשך חיי האופציה

$q$  - שיעור התשואה השנתית שמניב הנכס למשך חיי האופציה

$\sigma$  - סטיית התקן השנתית של תשואות מחירי נכס הבסיס

$N(d)$  פונקצית ההתפלגות המצטברת הנורמלית סטנדרטית עד לנקודה  $d$



# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
import numpy as np
import scipy.stats as si
def PolanitzerPutValue(Maturity, Spot, Strike, RiskFree, Yield, Volatility):
    d1 = (np.log(Spot / Strike) + (RiskFree - Yield + 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    d2 = (np.log(Spot / Strike) + (RiskFree - Yield - 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    PolanitzerPutValue = Strike*np.exp(-RiskFree*Maturity)*si.norm.cdf(-d2,0.0,1.0)-Spot*np.exp(-Yield*Maturity)*si.norm.cdf(-d1,0.0,1.0)
    return(PolanitzerPutValue)
```

## 19. פיתוח קודים לתמחור נכסים פיננסיים

❖ מהו השווי ההוגן של אופציית Put לשנתיים, אם ידוע כי שער הספוט הינו 4.5 שקלים לדולר ארה"ב, מחיר המימוש הינו 4.6 שקלים לדולר ארה"ב, סטיית התקן השנתית של תשואות שע"ח שקל-דולר היא 20%, הריבית השקלית השנתית הינה 5.0% והריבית הדולרית השנתית הינה 3.0%?

# 19. פיתוח קודים לתמחור נכסים פיננסיים

```
[44] import numpy as np
import scipy.stats as si
def PolanitzerPutValue(Maturity, Spot, Strike, RiskFree, Yield, Volatility):
    d1 = (np.log(Spot / Strike) + (RiskFree - Yield + 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    d2 = (np.log(Spot / Strike) + (RiskFree - Yield - 0.5 * Volatility ** 2) * Maturity) / (Volatility * np.sqrt(Maturity))
    PolanitzerPutValue = Strike*np.exp(-RiskFree*Maturity)*si.norm.cdf(-d2,0.0,1.0)-Spot*np.exp(-Yield*Maturity)*si.norm.cdf(-d1,0.0,1.0)
    return(PolanitzerPutValue)

PolanitzerPutValue(2, 4.5, 4.6, 0.05, 0.03, 0.2)

0.4354629672557555
```

# נשמח לעמוד לרשותכם

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