Εργαστήριο Προηγμένοι Μικροεπεξεργαστές

Αναφορά 1ης Εργαστηριακής Άσκησης

# **Ομάδα Β3**

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| Φοιτητές | ΑΜ |
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| Μαγκλάρας Θεμιστοκλής Παναγιώτης | 1047182 |

**Εισαγωγή:**

Σκοπός της 1ης εργαστηριακής άσκησης είναι να υλοποιήσουμε το κύκλωμα που περιγράφεται στο εγχειρίδιο των ασκήσεων και στη συνέχεια με τη χρήση κατάλληλου κώδικα να πετύχουμε τη επιθυμητή λειτουργία του. Συγκεκριμένα, το λαμπάκι LED του κυκλώματος θα πρέπει είτε να μεταβαίνει στην κατάσταση «ΑΝΑΒΟΣΒΗΝΕΙ» είτε να παραμένει σε σταθερή κατάσταση (σβηστό ή αναμμένο). Για να το υλοποιήσουμε, αυτό θα χρησιμοποιήσουμε τη μονάδα ελέγχου εισόδου/εξόδου Α, τη μονάδα των διαχείρισης διακοπών και τη μονάδα του μετρητή. Παρακάτω, φαίνεται το κύκλωμα που υλοποιήσαμε στην ώρα του εργαστηρίου:

![Εικόνα που περιέχει αντικείμενο

Περιγραφή που δημιουργήθηκε αυτόματα](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDqRXhpZgAATU0AKgAAAAgABAE7AAIAAAAPAAAISodpAAQAAAABAAAIWpydAAEAAAAQAAAQ0uocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAM6Yzr/OtM+Jz4HOrs+CAAAABZADAAIAAAAUAAAQqJAEAAIAAAAUAAAQvJKRAAIAAAADOTIAAJKSAAIAAAADOTIAAOocAAcAAAgMAAAInAAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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HSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A+kaKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKy/E+uR+GfC2pa3NC08dhbvO0SHBcKM4BoA1KK5XwP8AEXQPHuniXSLjy7xEDXGnz/LPB9V7j0YcGuqoAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigArlPilFJP8KPE0UKNJI+mzBUQZLHaeAK6uigDzZPhfoPi3wX4du72G403WrfTLYRanYuYLmJhEo5Ydcehzjtiorfw78W9Bmji03xdo+v2SsM/2xaNFMqZ5G6PO4+5NenV5B+zVreq698NtQutc1O81K4TVpI1lvLhpnVRDCQoLEnGSTj3NAHr9FFY+qa3fafeeTa+GdV1NNobz7SS1CZ9P3kyNn8MUAbFFc3/AMJTqv8A0I3iD/v9Yf8AyTR/wlOq/wDQjeIP+/1h/wDJNAHSUVzf/CU6r/0I3iD/AL/WH/yTR/wlOq/9CN4g/wC/1h/8k0AdJXOajq+qX+tzaL4YFvFJaqpvtQuozJHblhlY1QEF5CpDdQFBBOcgUn/CU6r/ANCN4g/7/WH/AMk1D8PpWutI1O7mtpbae41e8aWKYqZFIlKBWKkqSFVV4JHHBoAdJpvi7T4zcWGvQ6u6jLWd/aJEsnsskeCh9yHHt3rY0TWINd0mO+t0kiyzRywyjDwyIxV0YeqsCOOOMjI5rQrhNN1i80rxd4stbHw3qmpwnUopfMs3tlRGa0gLDEsyHJPJwMc9c5oA7uiub/4SnVf+hG8Qf9/rD/5JqW18R6lcXcUMvg7XLZJHCtPNLZFIwT947bgtgewJ9jQBv0UUUAFFFFABRRRQAUUUUAFFFFABRRXPeLPG+k+DFsjrAune+kMVvHaW7TO7AZI2rz0oA6GiuL0v4r+GdS1i10uRtQ067vH2WyajYS24mb+6rMuM+2ea2dL8V2Or+LNe8PW0Vwt3oX2f7S8iqI385C67CCScAc5A59aANuiuIvfiz4dt9QuLTT4NW1o2jlLqbSdOkuYrdh1DOoxx7ZrpPD/iPSfFOjx6poN4l5aSEqHUEFWHVWU4KkehANAGnRXPp430KTx1J4QW6P8AbEcHnmIoduMA7d3TdtYNj0Oa6CgAoorHfxTpC+LovDIulfVpLZrowJz5cakDLemd3A74NAGxRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVkeKvEEPhTwnqWu3UbSx2Fu0xjU4LkDhc9snAz71r1R1vR7PxDoN7pGpIXtL2FoZQDg7WGMg9iOoPrQB5zbaD8WfEtrFqN743svDIuEEi6fY6Wlx5QPIVncgkgdcHGag1O/+InwytV1rxF4gsvFegQyxpe7rFbW4gjZgvmJs4bBIyDn+osQeGvi54dgSw8P+JtA1ewgURwNrNvIkyoOgJjB3EDjJ605/AfjnxfJbw/EjxFpv9kRTJNLpWj27BLkoQyq8j/NtyASMc/kQAeo1j6pe+ILe82aTotne2+0HzZtRMLZ7jb5TfnmtisfVD4l+2f8SVdKNttH/H20gfd3+6MYoAp/2p4w/wChY07/AMHJ/wDjFH9qeMP+hY07/wAHJ/8AjFGfHH9zw/8A99z/AOFGfHH9zw//AN9z/wCFAB/anjD/AKFjTv8Awcn/AOMUf2p4w/6FjTv/AAcn/wCMUZ8cf3PD/wD33P8A4UZ8cf3PD/8A33P/AIUAH9qeMP8AoWNO/wDByf8A4xUPw9eeTQr97yFYJ21e+MkSSb1RvtD5AbAz9cCps+OP7nh//vuf/Cofh79o/sK/+2+ULj+177zfJzs3faHzjPOPrQB1VcJYXmu2/jPxauj6Pa30Jv4C0k1+YCG+xwcbfLbPbnNd3XCWB8RDxn4t/sNdLMH2+Dd9saQNu+xwdNoxjGKANf8AtTxh/wBCxp3/AIOT/wDGKltdR8UyXcSXfh2wggZwJJU1UuUXPJC+SMn2yPrUWfHH9zw//wB9z/4VLanxh9ri+2poYt9483yWm37c84yMZx60Ab9FFFAGRrviKDQWso5bS8vJr2VooYrOIOxIQuTgkcYU1S/4TF/+hY8Qf+Ai/wDxdHiH/kcPCX/X5cf+kstdJQBzf/CYv/0LHiD/AMBF/wDi6P8AhMX/AOhY8Qf+Ai//ABddJRQBzf8AwmL/APQseIP/AAEX/wCLo/4TF/8AoWPEH/gIv/xddJRQBzf/AAmL/wDQseIP/ARf/i6P+Exf/oWPEH/gIv8A8XXSUUAc3/wmL/8AQseIP/ARf/i64T4j67eTeIvAeoafoF/JdQ6vMsdhcbIJJj5HYltoHPUnsa9frnfEXhMa/wCIPDuqG8+z/wBiXb3Ij8rd525Cu3ORt65zzQBxeu2njL4i3WjadqHhH/hHdOstThv7i9utQimkIiJOyNY84Y9Nx6VmzXd3YeMvjhd6cSLuDTLGSEr1VhZSEEe4617RXM6P4NTS/G/irxBJdi5TxELVWtWhwIRDEY8FsnfuznoMdOaAI/hhZWVh8LPDcWmKggbToZCUx8zsgZ2PuWJJrl9CvLTw78ZPiC0bLDpUVhbajfBfuxTbGLNjsWUbj69avW3w68R+HUksfA/jRtL0d3ZorG809bv7JuOSInLA7cnhWyB+dOn+E0D+BtU0GHWrn7Zrc6zarq06CSe7wwLLwQFBA2gDgAng5oA8fHi7SYfClv4xE9yfFya62tywfYZ8GBz5bW4lKbNvkY5zjjrX03Y3sGo6fb3tnIJbe5iWaKQdGRhkH8jTZNPtJNLbTXgQ2bQmAw4+Xy9u3b9McV5jo/jvwV8JNOTwR4k8XtPe6V8oL6dPuSNx5kaEorKcK4GQemOBigD1evJdM8KaV4T+O2jW2kRSbp9Eu5bi4nlaWa4k82PLu7csf09MV0nh74xeBPFWvW+jaDrv2vULnd5UP2OdN21S5+ZkAHyqTye1a9z4WFz8QbDxR9r2mzsJbP7N5ed+9lbduzxjb0x360AJc+K3t7qWAeHdcm8tynmRWqlHwcZU7uQe1R/8Ji//AELHiD/wEX/4uukooA5v/hMX/wChY8Qf+Ai//F0f8Ji//QseIP8AwEX/AOLrpKKAOb/4TF/+hY8Qf+Ai/wDxdH/CYv8A9Cx4g/8AARf/AIuukooA5v8A4TF/+hY8Qf8AgIv/AMXR/wAJi/8A0LHiD/wEX/4uukooA5W58dxWUImvdA123g3ojSyWihU3MFBPz9MkV1Vcl8Ub+DTPh1f3d2SsMcttuKjJGbiMdPxrraACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAM3UvEOk6Rf2FjqV/Db3Woy+VaQu3zzN6Aflz05HrXPv8AFjwZH4zPhaTWUXVBMLcqY38sSn/ln5mNu7PGM9eOvFcx481JfB/xatfFmraPealp/wDYbWdm9tbmbybsSl8f7BdSAG9j71x0uj3mn/BbT/Cd1pl1N4w8X339okLAc27+ejNLI38G1Nuc8gk9s0AfRVY+qWfiKe836RrOn2dvtA8q401p2z3O4TJ+WK2Kx9U0XUL+886z8T6npke0DyLWG1ZM+uZIXbP44oAp/wBm+M/+hl0j/wAEj/8AyTR/ZvjP/oZdI/8ABI//AMk0f8IxrP8A0PWuf+A9h/8AI1H/AAjGs/8AQ9a5/wCA9h/8jUAH9m+M/wDoZdI/8Ej/APyTR/ZvjP8A6GXSP/BI/wD8k0f8IxrP/Q9a5/4D2H/yNR/wjGs/9D1rn/gPYf8AyNQAf2b4z/6GXSP/AASP/wDJNQ/D1J49Cv0vJUmuF1e+EkkcZjV2+0PkhSTge2T9am/4RjWf+h61z/wHsP8A5GqH4ewyW+hX8M1xJdSJq98rTyhQ0hFw/wAxCgLk+wA9qAOqrhLC01+fxn4tbRdXsbKEX8AaO505p2LfY4OdwlTAxjjH413dcJYaPf6h4z8Wy2fiPUtKRb+BTFaRWzKx+xwfMTLE5z24OOOlAGv/AGb4z/6GXSP/AASP/wDJNS2th4sju4nvPEGlzW6uDJHHpDozrnkBvtBwffB+lRf8IxrP/Q9a5/4D2H/yNUtr4e1WC7ilm8ZazdRxuGaCWCyCyAH7pK24bB9iD7igDfooooA5vxD/AMjh4S/6/Lj/ANJZa6S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YXh/4J+APDWopf6doEb3Ubbo5LmV5thHQgMSAR64zXe0UAFFFFABXN+GP+Rl8Zf8AYXi/9ILWukrm/DH/ACMvjL/sLxf+kFrQB0lFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFc34Y/5GXxl/2F4v8A0gta6Sub8Mf8jL4y/wCwvF/6QWtAHSUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABUV1bJeWkttMZBHKhRjFK0bAH0ZSGU+4INS0UAcFqnhmKyvPKsdD8T6lFtB8+HxROi59MPcg/pWdF4bWCWeWHwX4pjkuHEkzL4qcGRgoUM3+l8naqjPoAO1ej3tlb6jZS2l5H5kEo2umSMj6jmsiz8E+HrC8iurTThHPE25H81zg/QtigCt4d8N2sJh1GS11qwuo2bFve65cXIHbJXznRuD3ziunoooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooA/9k=)

**Πείραμα:**

Είναι καλή πρακτική πριν ξεκινήσουμε οποιαδήποτε εργασία πάνω στο κύκλωμα μας, να κάνουμε αποσφαλμάτωση των υλικών που χρησιμοποιούμε στο κύκλωμα. Έτσι, λοιπόν, ξεκινάμε τη διαδικασία του Debugging.

**Debugging:**

Ελέγχουμε τα βασικά στοιχεία του κυκλώματος που είναι το λαμπάκι (LED) και ο διακόπτης.

1. **LED**

Η γραμμή 1 οδηγεί στο LED οπότε πρέπει να κάνουμε τα ακόλουθα βήματα για να δούμε αν τελικά το λαμπάκι μας λειτουργεί σωστά. Συγκεκριμένα:

Ρυθμίζουμε τη γραμμή 1 ως γραμμή γενικού σκοπού με την εντολή:



Μετά ρυθμίζουμε τη γραμμή 1 ως γραμμή εξόδου με την εντολή:



Στη συνέχεια, για να τεστάρουμε το λαμπάκι μας, εγγράφουμε στο bit 1 του καταχωρητή PIO\_SODR την τιμή 1, οπότε αυτό θέτει τη γραμμή 1 σε υψηλό δυναμικό. Αυτό σημαίνει οτι το λαμπάκι θα πρέπει να ανάψει. Πράγματι, όπως διαπιστώθηκε την ώρα του εργαστηρίου το λαμπάκι άναψε. Αυτό το πετύχαμε με την εντολή:



Αντίστοιχα, εγγράφοντας την τιμή 1 στο bit 1 του καταχωρητή PIO\_CODR, η γραμμή τίθεται σε χαμηλό δυναμικό και όπως παρατηρήθηκε και στο εργαστήριο το λαμπάκι σβήνει. Η εντολή που εκτελέσαμε ήταν η ακόλουθη:



Επομένως, το λαμπάκι λειτουργεί ορθά.

1. **Διακόπτης**

Η γραμμή 0 οδηγεί στον διακόπτη άρα πρέπει να είναι γραμμή εισόδου. Για να το κάνουμε αυτό, πρώτα μετατρέπουμε τη γραμμή 0, σε γραμμή γενικού σκοπού με την εντολή:



και στη συνέχεια την ρυθμίζουμε ως γραμμή εισόδου με την εντολή:



Στη συνέχεια, για όσο διάστημα ο διακόπτης δεν είναι πατημένος, η γραμμή δεν οδηγείται από εξωτερική πηγή και άρα μένει σε απροσδιόριστη κατάσταση. Για να το αποτρέψουμε αυτό εκτελούμε την εντολή:



η οποία εξασφαλίζει ότι το δυναμικό της γραμμής εισόδου θα παραμένει υψηλό (ενεργοποίηση pull-up).

Τέλος, για να τεστάρουμε αν ο διακόπτης λειτουργεί εκτελούμε 2 φορές την εντολή:



Την πρώτη φορά εκτελούμε την εντολή με τον διακόπτη πατημένο. Αυτό σημαίνει οτι θα υπάρχει χαμηλό δυναμικό στη γραμμή εισόδου 0. Η παραπάνω εντολή διαβάζει από τον καταχωρητή PIO\_PDSR, στον οποίο η τιμή 1 σε κάποιο bit σημαίνει πως η αντίστοιχη γραμμή δέχεται ως είσοδο υψηλό δυναμικό. Έτσι, λοιπόν αναμένουμε 0 στο bit 0 του καταχωρητή. Πράγματι, όπως διαπιστώθηκε και στο εργαστήριο η τιμή του bit 0 ήταν 0. Αντίστοιχα, τη δεύτερη φορά που θα τρέξουμε την ίδια εντολή χωρίς να κρατάμε πατημένο τον διακόπτη η γραμμή δέχεται ως είσοδο υψηλό δυναμικό και άρα η τιμή του bit 0 είναι 1, όπως είδαμε και στο εργαστήριο.

Άρα, τα παραπάνω μας επιβεβαιώνουν ότι τόσο το λαμπάκι όσο και ο διακόπτης λειτουργεί σωστά.

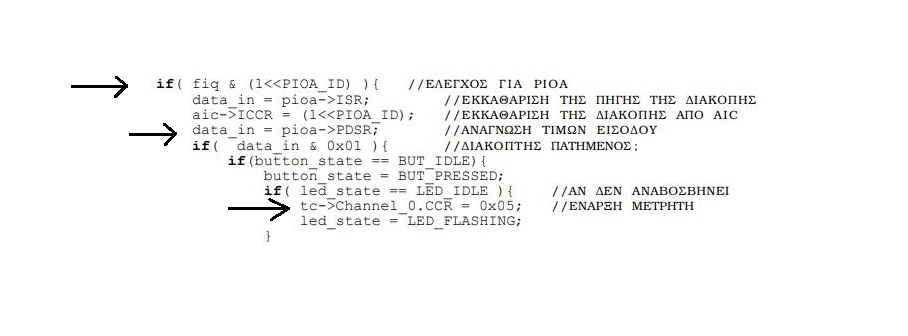
Επομένως, έχοντας ελέγξει τα βασικά στοιχεία του κυκλώματος, υλοποιήσαμε το κύκλωμα την ώρα του εργαστηρίου και παράλληλα φορτώσαμε τον κώδικα στο ΑΤ91 ώστε να ξεκινήσουμε με την υλοποίηση της άσκησης.

**Αποτελέσματα - Διορθώσεις:**

Πριν, ξεκινήσουμε με το πάτημα του διακόπτη για την παρατήρηση της εναλλαγής καταστάσεων στο λαμπάκι, πρέπει βεβαιωθούμε ότι ο κώδικας μας είναι σωστός ώστε να προγραμματιστεί σωστά η πλατφόρμα ΑΤ91 για να προκαλούνται οι κατάλληλες διακοπές. Ωστόσο, ο κώδικας μας δεν μπορεί να γίνει compiled, άρα επανεξετάζουμε τον κώδικα και παρατηρούμε ότι δεν έχει δηλωθεί η μεταβλητή tmp που χρησιμοποιείται μέσα στον κεντρικό βρόχο για την ανάγνωση της τιμής του πληκτρολογίου. Επομένως, ορίζουμε την μεταβλητή tmp τη χρήση της εντολής:

**char tmp;**

Η εντολή τοποθετείται έξω από τη main και αυτό μας επιτρέπει να κάνουμε compile τον κώδικα μας. Ωστόσο, πατώντας τον διακόπτη, πάλι βλέπουμε ότι δε συμβαίνει τίποτα. Το λαμπάκι δεν λειτουργεί όπως μας ζητά η άσκηση. Αυτό οφείλεται στο γεγονός ότι την πρώτη φορά που θα πατήσουμε τον διακόπτη, θα δημιουργηθεί μια FIQ διακοπή από την μονάδα ελέγχου Α. Αυτή με τη σειρά της, αν ο διακόπτης δεν παραμείνει πατημένος (αν παραμείνει πατημένος τότε, θα υπάρχει πάντα χαμηλό δυναμικό στην είσοδο και οπότε δε θα καλύπτεται η συνθήκη στο πρώτο εσωτερικό if αφού ο καταχωρητής PIO\_PDSR θα έχει 0 στη θέση 0), θα ενεργοποιήσει τον μετρητή. Αυτό φαίνεται στον παρακάτω κώδικα:



Αφού ενεργοποιηθεί ο μετρητής, αυτός με τη σειρά του μετά από 1 δευτερόλεπτο θα προκαλέσει FIQ διακοπή και θα εκτελεστεί ο παρακάτω κώδικας:

![Εικόνα που περιέχει πουλί

Περιγραφή που δημιουργήθηκε αυτόματα](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RD2RXhpZgAATU0AKgAAAAgABQESAAMAAAABAAEAAAE7AAIAAAAPAAAIVodpAAQAAAABAAAIZpydAAEAAAAQAAAQ3uocAAcAAAgMAAAASgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAM6Yzr/OtM+Jz4HOrs+CAAAABZADAAIAAAAUAAAQtJAEAAIAAAAUAAAQyJKRAAIAAAADNzIAAJKSAAIAAAADNzIAAOocAAcAAAgMAAAIqAAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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qNDU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A/fyiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKZvOfwrz341fHxfgynh5To99r114i1q00lbaxuLWOWzjmk2tduLiWLMUeV3BC8mWAVGpX1S7uwdLnotFeT/tfftgeEf2I/gXq3xC8a3N4NJ0kRRraWUSzXmozyyCKK3t0ZkV5XkdRgsAOrFRk1l/sdfthyftfeGdY1MfD34gfD7+xbpLRoPFFvZKbwlN5e3ktLm4jkVcqGO4EHtT3vbp/X6h28z2yiuP8AhZ8X7H4uR67NpcV4bLQ9YuNF+0yRhY7ua2PlztGc/NGsoePd/fjcdq6uWfyYS7Mqqq5LHtRfS4dbEtFeM/Dr9snTfi38WLzw54a0TUtY03TryexuNfttS0p7JJIOJj5P2z7WUV8RbxBjfzjZ89dt4c+Jj+JviHr2j29vayafosFsRqMOoQTCa4keZZoGhVjJEYRHGxL/AHvOwPuGjt5h38jsKK5nVfix4d0fxE2jXXiHQ7TWPs73i2M19Ety0KEb5fKLB/LT+JiAB3I61u2Wox6jbRTW80c8MyCRHjYMHVujKRwR70LVXDrYs0VxfxV+OGh/BfTLG612bUf+JlefYbW203SbrVbu5l2M+1Le1jklICI0jNtwqrziusstQXULKO4jD+XIm9cqVY+2080LVXDrYsUUVwXhT482fjvw14m1bRdL1fVbTw7qd3pMYt44y2rT2pMcwt8vyonV4MvsG+Jz9zD0Ad7RXEfBH4y/8Lr+H8euLouqeH5vt99ps+m6k9v9ptJrW7ltnSQwyyx53RMfkdx706X48eHV+KqeC4b977xIyGaa0sraS5Gmx7dytdSIpjtgw+6JmRnPyoHNAHa0VxPjD48eG/AvjnS/DF9qnmeJNaZTaaXaW0t3deUz7fPkjhV2jgDAgzSBY8/KW3YryfVf+ClHhXRrq683wr8RmsrS3vL2S+TRAbb7LaTi3muAd+TEJMDPcHNC1aXf/h/yB6Js+jqK8f8AiL+15pngXxDrFhb+H/GXiGLwyo/t+90XSjd22hlkSRVcht8shjkSQx26TOiOrOqgqGj8UftdQouhR+EfC+v+O7zXNFTxJ9l017e3ktNNbbslkFxJHh5MkRx9XMcnK7aL6X/rv+Qf1+n5nslFYvgTxvZfEjwTo3iHSpvO0zXrGHUbR2XaXhljV0J+oYGs/wCKHxKPws8HTaxJo+va8tuyiS10e0Fxc4PVghYfKMc80nJJNsN3Y6qivH4P2xdJm/ZzuvifJ4Z8bW3h+3jiuFtpdNRdQuYJFiZZUi8zlMSjnP8AC3pWz8Lv2jtN+J+tXmjf2X4k8PeIrGEXUmla3prWNxNDnaJYSSYpV3DnZI2zKh9u5ct3V79A3V0ej0VyHwe+L+n/ABr+G2m+JtLE0NrqG+Nre5Tyri0njlaKe3lXnbJFIjow7MjV19ABRXG+Evi/ZeKviP4p8LLFd22r+FHtWuI50A8+3uIQ8VxHj70bMs0ef79vKO1Hj74tReBPEPhbS/sOoajeeLNSbTbVbXygsDJDLNLLJ5jpmOOOF2ITdI2BhTR0T7h1a7f5XOyooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAIz1/Cvz2/4LV/AHxx+0Ld+CbXwH+zOfij4i8K6vpOu2PjX+1dBsptFjt9UiubmwhN5PHcqZY7dFJQCMiX73DV+hm2mfZI+PkX5TkHHQ8/4n8zU63i10dw+y0fnP/wAFcPg18SP2+/2GPC+mw/sp3XiH4iXWqxXv9narrvhyS68GRwahbyzL9pkuTGy3lvC0RFu7BkbbLgcV9T/sE+ArLwJ8Dvstj8B9P/Z1WTUZppPCdm2lMgPAFznTme3JkAH8W4AfSvc/IU/w5+tNNtGf4R6/j6/X3px0vbr/AMD/ACQPW3keEf8ABP8A0q48D/s9SeENShaHWPBmv6tpeol02+cxvprmO4yQNyzQzwzbh0MxH3lavb7+Vo7OVlha4ZY9whXG6T254qwkCoTx16nuar3d2mn2s0s00ccEKNI7yEKqKOSSTwABSk7QsPeVz5v/AGIvBc3g7XvEC6j8CtW8AXN9rGq31rrFzHoTR/Zp7ovFbg2d5NMCyMpICeX8md2es/wyvfEWhftfeKNYh+B/jLQdG8UaZpunTaybrw+sLT29zqMkt1NHDqDXDoVuovm8oydtlbOjfty+FfH3xx8H+F/COpeHfEVj4nN2lxcxXkkN1CIraWeOe3j8orc27rER5yyBPmTazZrtNB/aW8D+LfiK/hKx8QWb6+JZIFt2jkSK5ljDNJHBKyiOWRArFliZ2QK25Rijql2E9m+58m/tf/B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GHiXWrrSv7DsdU1FLH7Vo9qMtmFEtlheVpCrvLNHJvMUYYFRis39lHzvBmt+J/BWpeH5NA1jSo7XVnSLxjqHii2uLe6adI3S4vkjljZWtpQ0WwAYUgtmuo/Z4+JHiz4jaZ4muPF2heGdCfT/Ed7p2lHRte/teG/sInVIbmVxGghnfndAclCOuacu6/rS36h0t/XT/ACOO+HP7C+l/CzxL4Q1rS/HHjgaz4bNz/auoyDTftPjUXEnmsurOLPMxDfMrR+SynoRWtb/sj2UPxFXU/wDhJvE7eG4ddbxLF4UzajS49RYs5n3eV9pK+czTeWZjGJju2gAKPZRGoNAgUDG0UW2fb/h/zD7LXc8Lv/2N7q5+LniLxhYfFr4oaHqPihoxPb20ehyRW1vGPltrdp9OknitwSzbFkBLszk7mLHX+KH7Pd78Uf2kfhz4yuvEV7a+HPh7HfXCaHayyRR6pqE6pFFc3BVgrpBEJtqMCN8mewr13y1Hb3poto16L1xn88/zo7eQd/MkooopgFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVi+JPHmkeEZNOTVdW0/SW1a8jsLL7bOkH2y5kz5cEe8jfI2CAi5YkdK2q8b/AG2bm8h+BvmaXb2txqUfiPQTZR3EzQwzzrrNmUjkmRXaKNmwjOEkKIzt5bhSpAPZKKarEJ83FOoAKaY1Ix29KdRQB5l4B/ZZ8M/DjxqNa0u68XxmGa4nttOl8T6jNpdq87M8my0acwYLOxVShCZ+QKMVU0z9jzwXoPisana/8JRDax3x1KPR08Sah/YsNy0nmlxY+f8AZ9vm/vPL8vYJPnChvmr1by1BpQgH5Yz3qddH2AFQIOPy9KwLH4VeHdO8fX3iqPR7P/hJNRiS3m1N18y68pRhYldslIxydiYXczNjLEnoKKoDgfi1+zr4c+MWpWOoah/bmnaxpkbw2upaJrF3pN5HE/LRNJbyRs8RIDGN9ybgDjIBqnb/ALJPgWzv/BtzDY63BN4Duri90hovEWpJi4uAwnmuAJwLySTe+97nzWYySEkl2J9I8tcf1zTqAPI2/Yx8DReHb3T7RfFVobzXZPEovI/FWpveWmoyI0bzQzPcNJCrI7qY42WMq7DZgmqdj+wX8N7LwV4w0FbfxdJp/wAQJI5/ELP401pp9SlRFjEhmN35kblI40Zo2UusaqxYKAPZjEpPT3oEailr/Xy/y/BB1uef6p+zN4U1XxPda1MPE39pXnh4eF5po/FGpx7rHJPCrcBRPliftIAnyc+Zmq/hf9k/wT4Rn8CyWFnrsX/Ct7Way0BX8R6lKlvDLH5brMrzlbr5AFBuBIVAG0ivSSuaAmKLf19/+b+8P6/r7l9yPKNC/Y/8H+EPFcGp6bJ4usba0uzfW+kweKdSj0e3mL+YWWyE4g2b/mEWwxA8hAeaXxV+xl4H8ZfFJfGV9N4+/wCEgh3+VLbePtetYIVdo3eNLeK8WFI2aJCY1QIdvTrXqvlru3Y59adjmlbbyB6nkniH9pzUtC1u8s4vhT8UtUjtZXiW8srSxe2n2/xIxugSp7ErUviP4V6J+1F4b0XWtd0fxh4V1O1W4itvK1WbSNWtYpCFlieSyuAfLkEaEoZCuVRsBlUj1MW6b9235vU9RStCrptPTjv6VXTz/pB1PO/ib+y14L+LP7PNx8K9Q066tfBNxZwaeLHStQuNNkt4ISjRIksDpKgBjX7rAkDByCc63xB+Bvhr4o+CLXw/rFlczWenSRT2UsN/cWt5YTRDbHNBdRSLPDKFLDzEkVyHcEkOwPX7F9PzpaAPMNK/ZO8E2PgvWtBvrLU9etfE20apca1q11qN7dhMGMC4mkaWMRsN8YjZRG+XUKxLVR0/9jPwXZ+HfEGm3T+MNUj8SaedKvLnUPFmqXF5HZkgtBFctcGaFW2jd5ToX2jcTgV635S0CJR27560rXTT6/8ADDu1Zo4HRv2Z/CHh+y8Hw29nqpbwG7NotzNrd9NeQKybGjkuHmM1xEy7QY53dCI48qfLTb6BnigjNG2h3buRGKWiGiNQOnrx9ad0oop+RR5v8ZP2X/CXxz1SK812HWI7pbOTTZ30zWbvTTfWch3Paz/Z5Y/OiJ52vkDc2Mbmzc1j9m3wf4g+KHh/xhcWGof214VsJtM0oQ6veQWVpbzKVkUWiSi2Ysp272jLAKoBAVcd2yBuozShcVPLpYDyXRf2MPAXhn4M2vgPT7LX7bw/p95/aNgW8SajPeaXcbt4a3u5J2uIQGzhY5FUBmAADEHW079mjwnpvwpm8Fx2urLo88rXc0w1i8W/kuWl84z/AGwS/aRL5nzbxJuGAAcAAeh7B6UbB6UW1b/r+tA/r+vvOA+G37Pmi/CLSdYTRZtYbVNdA+16vqeoz6nfzMilYcy3Du3lxgtsjBCKWYhQWJNT9ln9mnw7+yP8B/Dvw/8ACsUiaXoEBXz5QDc38zEtNcyt0Mskrs5PvjoAB6SEUHp160LEqjj6daoB1FFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVh+N/hxo/xGj02PWbaW8i0jUYNVtoxcyxRi5gbfC7qjASBHw4VwyhkRsblUjcooAMcUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAH/9k=)

To data\_out θα περιέχει στη θέση 1 την τιμή 0 αφού αρχικά το bit 1 του καταχωρητή PIO\_CODR που αντιστοιχεί στην γραμμή 1 πήρε την τιμή 1, το οποίο σημαίνει ότι η γραμμή 1 τέθηκε σε low δυναμικό. Ο καταχωρητής PIO\_ODSR αναπαριστά τα δεδομένα εξόδου κάθε γραμμής και άρα θα έχει 0 στο bit 1. Επομένως, στην αμέσως επόμενη γραμμή ο PIO\_SODR θα παίρνει πάντα την τιμή 0 στη θέση 1 (η τιμή 1 στη θέση 1 στον καταχωρητή PIO\_SODR, θα έθετε τη γραμμή 1 σε γραμμή υψηλού δυναμικού), γεγονός που σημαίνει ότι η γραμμή 1 δε θα γίνει ποτέ γραμμή υψηλού δυναμικού και κατά συνέπεια το λαμπάκι δεν πρόκειται να ανάψει ποτέ! Επομένως, δοκιμάζουμε να αλλάξουμε την εντολή που αρχικοποιεί τον PIO\_SODR και να την αντικαταστήσουμε με την ακόλουθη:

**pioa->SODR = data\_out | 0x02**

Αυτό σημαίνει ότι ο PIO\_SODR θα αρχικοποιηθεί με 1 στο bit 1, γεγονός που θα ρυθμίσει τη γραμμή εξόδου 1 ως γραμμή υψηλού δυναμικού, άρα το λαμπάκι θα μπορεί να ανάψει. Επομένως, αν τρέξουμε τώρα τον κώδικα και πατήσουμε την πρώτη φορά τον διακόπτη το λαμπάκι θα αρχίσει να αναβοσβήνει, αν στην συνέχεια κρατήσουμε πατημένο τον διακόπτη θα δούμε ότι λαμπάκι θα μεταβεί σε μια σταθερή κατάσταση (σβηστό ή αναμμένο) και ούτω κάθε εξής. Πέτυχαμε λοιπόν αυτό που θέλαμε.

**Συμπεράσματα:**

1. Είναι πολύ σημαντικό να κάνουμε αποσφαλμάτωση στα υλικά που πρόκειται να χρησιμοποιήσουμε στο κύκλωμα, προκειμένου να εξαλείψουμε τον κίνδυνο αποτυχίας λόγω hardware.
2. Είναι εξίσου σημαντικό να ελέγχουμε ενδελεχώς τον κώδικα μας, προκειμένου να αποφεύγονται συντακτικά αλλά κυρίως λογικά λάθη.
3. Πρέπει να είμαστε πάντα προσεχτικοί με την αρχικοποίηση μεταβλητών και κυρίως των τιμών των καταχωρητών.